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CONTENTS.

EDITORIALS:
Comparison of National Wiring Rules.....1065
Roentgen Rays 1066
Domestic Supply Problems in England.....1066
Sales-Department Organization 1067

DEPARTMENTS:
Commercial Practice 1073
Electric Sign Data 1080
National Association of Electrical Inspectors.....1090
Public Service Commissions 1092
New Electrical and Mechanical Appliances.....1098
Latest Approved Fittings 1103
Current Electrical News 1105
Record of Electrical Patents 1109
Electric Vehicle Section 1111

LEADING ARTICLES:
Electricity in the Publishing Business.....1069
Central-station Sales Department Organization and Work. —By F. D. Beardslee 1073
National Electrical Code Wiring Rules Compared with the German and English Rules 1081
Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon 1093

MISCELLANEOUS:
Street-Lighting Schedule for 1914 1068
Meeting of American Physical Society 1068
St. Paul Jovians Entertained by Tri-State Telephone Company 1068
Chicago Section, Electric Vehicle Association.....1068
December Institute Meeting 1068
Chicago Jovian League 1068
Advertising Electricity in South American Cities.....1079
Christmas Electric Appliance Campaign in Louisville....1079
Byllesby Properties New-Business Increase.....1079
Electrical Advertising 1080
Construction Details of Temporary Motor Installations...1089
Cincinnati Contractors Oppose Additional Inspection Fees.1091
Chicago Inspectors to Celebrate Anniversary.....1091
Boston Edison Safety Work Praised.....1092
Report on Water-Power Development of Sanitary District of Chicago 1096
Electrical Developments 1097
Kasson, Minn., Has White Way Celebration.....1097
A New Electric Garage for Charging on the Constant-Potential System 1111
The Value of the Ampere-Hour Meter to Drivers of Electric Trucks.—By A. R. Cordner.....1114

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COMPARISON OF NATIONAL WIRING RULES.

Attention is called to the comparison presented in this issue between the wiring rules in effect in the United States, England, and Germany. This comparison has been made in connection with the study by the National Electric Light Association Committee on Wiring of Existing Buildings, and is of value in emphasizing the points of difference in the standards of construction which are recognized in the respective countries.

It has been realized by many that electrical construction work in Europe is less expensive than in the United States, and that if something could be done in this country to eliminate any expense which may be found to be unnecessary for safety, it would result in a more rapid extension of electric service, and the utilization of electric light and electric appliances by a larger percentage of the American population. In many points, the National Electrical Code has not been found stringent enough for construction work in our large cities, many of which have adopted codes enforcing a higher standard. Nevertheless, there are probably many points in the National Code which might be modified without introducing either fire or life hazards, and if so, such modifications should be made in the interest of making electric service available to people of modest circumstances. It is a fact that electric service is too often looked upon, especially outside of the larger cities, as a luxury available only to the well-to-do. Any obstacles which may exist in the way of widening the usefulness of this agency of service to mankind should be removed, if this can be done without introducing any additional hazards.

The National Electrical Code is the result of much study by those instrumental in formulating it, and is intended to represent standards of construction which are safe and which are feasible for the entire country. Any code of this kind, however good at the time of its formulation, must require revision from time to time if it is to continue to represent the most desirable practice. The National Electrical Code is revised every two years, and the time for the next revision is approaching. A study of the standards in effect in other countries may point the way to desirable modifications of our own rules, and any changes which will reduce the cost of construction, without adding danger, should be adopted.

It will no doubt be generally agreed that many

of the American rules which are more stringent than the European rules, are, nevertheless, desirable. For instance, when we consider the growing tendency to attach to ordinary lighting circuits current-consuming devices which require a higher wattage than the lamp for which they are substituted, it would be very undesirable to reduce the minimum now required in the United States for the area of conductors used in wiring buildings. Other differences, however, will be noted in the comparison where the European rules are less stringent, and yet are sufficient for safety. In considering the comparison, differences in building construction in Europe and America should be taken into consideration. While the fire losses in Europe are notoriously lower than in this country, there is probably no connection between this fact and the standards of electrical construction.

ROENTGEN RAYS.

For many years after their discovery the nature of Roentgen rays, otherwise designated as X-rays, remained a mystery, although there were many speculations as to the constitution and method of propagation of this form of radiation. The new rays did not seem to conform to the laws of propagation of light, and consequently could not be classed as of the same nature. Recent investigations indicate, however, that the X-rays constitute the same type of radiation as visible light, but are so far removed from it in wave-length as to constitute an entirely different class. This radiation is as far removed from visible light as is the latter from ordinary sound waves. Thus while the wave-length of visible light is of the order of magnitude of one ten-thousandth centimeter in wave-length, the X-rays are waves whose length is of the order of one ten-thousandth of this, or a hundred-millionth part of a centimeter. So-called "hard" rays and "soft" rays differ from each other in wave-length. The wave-length is also dependent upon the metal used as anti-cathode, each element emitting radiation which is characteristic.

Light is diffracted into a spectrum by reflection from a grating, which consists of parallel lines ruled close together upon the reflecting surface. The distance between such lines must be of the same order of magnitude as the wave-length of the light. For waves of Roentgen radiation it is mechanically impossible to rule suitable gratings, so spectra of such radiation could not be secured by this means. The wave lengths involved here approach molecular dimensions.

How crystals have been utilized as reflectors to sift out the components of a beam of X-rays and how the resulting spectrum reveals the structure of the crystal were very elegantly demonstrated by Prof. W. H. Bragg in a lecture delivered at the University of Chicago last week upon the occasion of the meeting of the American Physical Society. Without following out all the steps of such a demonstration it is hard for one not intimately familiar with such work to realize how much progress such scientists as Professor Bragg, Rutherford, Thomson and others are making in the problem of elucidating the ultimate nature of matter and the structure of molecules and atoms. It should be appreciated, however, that electrical science has furnished the key to unlock such treasures of knowledge as have been acquired in this domain, and that scientists are steadily trending to the viewpoint that the fundamental relations of all matter are electrical in their nature.

DOMESTIC SUPPLY PROBLEMS IN ENGLAND.

English electric station managers who several years ago formed a select circle known as the "Point Fives" have been holding an interesting discussion on the domestic-supply position. There have not been wanting those who have indulged in very optimistic estimates concerning the proportions that the cooking and heating load would take in comparison with the power and lighting business. The figures have been at times startling in their magnitude and as an ultimate goal at which to aim no doubt they would serve a useful purpose, but some supply engineers hold in this connection that it is better for immediate practical purposes to deal with possibilities which, if not actually in sight, may reasonably be expected to be so before long. Several members of the association mentioned have been trying to bring their confreres down to earth again by disputing their assertions that the domestic load will eventually exceed industrial requirements, though they admit that it may approach the latter in magnitude and in some non-industrial areas will almost naturally exceed power requirements.

Mr. Pickvance, the borough electrical engineer of Wrexham, who set the ball rolling at the recent discussion, began by expressing this view. He went on to show that the motor load had been, in many cases, primarily developed by the exercise of powers to hire out motors, and in agreement with a large number of other station managers he holds that the application of this principle is essential in the cooking department if real headway is to be made. Their united efforts along this line would render it possible to secure the hearty co-operation of manufacturers by reason of the fact that collectively they would be able to place orders in quantities much larger than is at present possible and so the price of the apparatus would fall. The power load had been developed partly, or mainly, because supply authorities had an efficient, economical and cheap electric motor available. He asked: Has the present-day small-central-station engineer a cheap and reliable cooker at his command? "Electrical cooking as applied at present might very reasonably be termed a luxury. The vast body of artisans and the working class generally could not be approached. It was to this class that the small station engineer with his

negligible power load had to look to save him from extinction." He added, no doubt with a view to stimulating a lively debate, that practically all the advocates of electrical cooking were toying with the subject.

Mr. Allen, of Wolverhampton, urged that they should concentrate on domestic supplies, and secure hiring-out authority in every town, but he admitted that although 80 English towns possess such powers already, few of them exercise them owing to the apathy either of the municipal authority controlling the undertaking or of the engineer in charge of it. He was far from accepting Mr. Pickvance's description of electric cooking as "generally a luxury."

A later speaker expressed the view of that element that regards the principle of hiring heaters and cookers as being at present not altogether sound, owing to the fear of obsolescence. He favors hire-purchase only, and in contradistinction to the "luxury" idea he holds that it is not the wealthier class of consumers who adopt domestic electric contrivances but the small consumer to whom a saving in domestic labor is a very important matter. This opinion was strongly supported by Mr. Fedden, electric supply manager of Sheffield, who finds it easier to secure the small man, urges the importance of hiring, does not see any prospect of the domestic exceeding the power load (Sheffield is, of course, a great industrial center), says that cookers must be reduced in price, and believes that in a short time a number of Point Five members will be selling electricity for domestic use at a secondary rate not more than 0.5 cent per kilowatt-hour.

Perhaps the most hopeful features of the entire debate were the confident statements of two speakers to the effect that the water-boiling problem, which has always been an insuperable difficulty in domestic service, is about to be overcome. The debate may be described as a useful all-round one on the domestic electric supply problem as it confronts engineers and managers in England today, but from what we have said above it will not be apparent that English officials have yet reached a point at which their own convictions can be turned to good account in an aggressive and enterprising campaign. Maybe they were talking under the influence of the clouds of war and with the knowledge that customs of economy are likely to be practiced in circles high and low in England for a time.

Several speakers showed their appreciation of the successful efforts made by manufacturers to render cooking apparatus more reliable, and others mentioned their own efforts to popularize such service in small-class property. For instance, Mr. Bowden, of Poplar, said that he had fitted a number of artisans' dwellings with six lamps and a hot plate sufficient to do nearly all cooking required, and the total charge for apparatus and service was from 36 cents to 48 cents per week.

SALES-DEPARTMENT ORGANIZATION.

The time when the sales department of a central-station company was considered as simply an unnecessary adjunct to the organization and in some cases as a department to be manned by individuals who knew perhaps less regarding the central-station business than employees in any other department, has fortunately passed. Today, all progressive companies fully realize the importance of the commercial end of the business and in fact the progressiveness of many organizations is measured by the policy and accomplishments of the sales department.

The present tendency is admirably shown in the comprehensive article by Mr. F. D. Beardslee, appearing on other pages of this issue. First in importance, and second only perhaps to the ability and character of the chief executive himself, comes the personnel of the department. A majority of a central-station company's consumers rarely, if ever, see any other representative from the company than its salesmen, unless it be the meter reader. It is especially important, therefore, that the salesmen should be, not only in name but in reality, representatives of the company. This means not only a working knowledge of the technical phase of the business, coupled with sales ability but, what is eventually more important, a thorough understanding of the company's methods of handling its business with the public, and of its public policy. A company is as friendly with the public, and as successful, as its representatives make it.

In St. Louis, and elsewhere, department and interdepartment meetings are held at frequent intervals to imbue the sales-department employee with the policy of the company and regular classes are held to instruct the men in this as well as in general features of central-station work. Certainly men sent out by a company so equipped are better able to represent a utility than men simply given a territory and told to "get the business." An executive cannot hope to achieve success unless his policies are understood and carried out by his subordinates.

Another feature to which Mr. Beardslee attributes the success of the St. Louis company, is the co-operation which exists between the various departments of the company. This means frequent meetings between department heads. The ultimate connection of a new customer to central-station service involves so many departments that unless the fullest co-operation is obtained the new customer is at once led to assume that either the organization is inefficient or the company is taking an indifferent attitude after the contract has been signed. It is gratifying to observe that in St. Louis, because of the co-operation between departments and because of the splendid organization of departments, much of the red-tape incident to a service connection has been eliminated and customers are in many cases furnished service the same day the contract is signed.

Street-Lighting Schedules for 1914.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has published for the year 1915 its customary tables for street lighting on schedules commonly used. These show in tabular form the proper time for lighting and for extinguishing street lamps on the all-night schedule and the Philadelphia moonlight schedule. These tables, as usual, are printed on a sheet forming an insert in a small booklet containing detailed instructions on the use of these tables and other useful information in regard to the schedules. This sheet may be removed from the booklet, if desired, and mounted on a wall.

The booklet gives also the total number of hours of lighting for each month and for the year for the two schedules given in detail and also for a simplified form of Frund's schedule and for the moonlight-midnight schedule, the two latter being readily derived from the published schedules by simple rules which are given in the preface to the tables.

As heretofore, a copy of the lighting tables will be sent gratis to any subscriber requesting one. The price for additional copies and to others than subscribers will be ten cents.

Meeting of American Physical Society.

A meeting of the American Physical Society was held at the University of Chicago on November 27 and 28. The session on November 27 was devoted to a symposium on "Spectroscopic Evidence Regarding Atomic Structure." On Friday evening a lecture was delivered by Prof. W. H. Bragg, of the University of Leeds, England, on "X-Ray Spectra."

Among the papers presented at the session on November 28 were the following: "Thermal Capacity of Tungsten at Incandescent Temperatures, and an Apparent Lag of Radiation Intensity With Respect to Temperature," by A. G. Worthing, of the Nela Research Laboratory, Cleveland, O.; "Saturation Value of the Intensity of Magnetization of an Iron-Cobalt Alloy," by E. H. Williams, of the University of Illinois; "The Direct-Current Corona of a Wire Through a Circular Opening of a Disk," by L. W. Faulkner, of the University of Illinois; "Experimental Detérmination of the Relation Between the Corona Current and the Increase of Pressure Due to Direct-Current Corona; Possibilities of a High-Potential Voltmeter Based on This Pressure Phenomenon," by E. H. Warner, of the University of Illinois; "Determination of the Elementary Charge of Electricity by Means of Magnetic Properties and the Magneton," by Jacob Kunz, of the University of Illinois; "The Variation of the Wave-Length-Sensibility Curves of Selenium With Temperature," by E. O. Dieterich, of the State University of Iowa.

Dr. Worthing gave as the values for the specific heat of tungsten 0.04 to 0.05, at temperatures from 1,600 to 2,200 degrees absolute.

Mr. Williams used an ellipsoidal specimen of Fe_2Co, 12 by 16 millimeters in size. The maximum value for the intensity of magnetization in C. G. S. units was 1,791 after melting in a vacuum under reduced pressure, 1,962 after forging, and 2,050 after remelting and forging. The average values for iron are 1,700 to 1,800.

Mr. Faulkner observed the discharge between a wire and the edge of an angular disk through which it passed. The lowest discharge voltage giving a visible discharge was smaller when the wire was the negative electrode, and decreased as the pressure was decreased. The wire was two millimeters in diameter and the disk was 1.5 millimeters thick.

Mr. Warner found a straight-line relation between the corona voltage and the pressure produced by ionization. For a discharge voltage of 15,000 volts the pressure increase amounted to 1.2 centimeters of mercury.

Dr. Kunz, from experiments on a number of magnetic materials, deduced a value for the elementary charge of electricity which is about 4 per cent less than the value found by Professor Millikan by a more accurate method.

Mr. Dieterich found that the variation in sensibility of selenium with change in wave-length was less at higher temperatures than at ordinary temperature. Thus at 132 degrees centigrade the variation was less than half at 23 degrees. Moreover, the maximum sensibility occurs for a longer wave.

St. Paul Jovians Entertained by Tri-State Telephone Company.

The St. Paul Jovian League was entertained on Thursday, November 1, by W. S. Williams, manager of the St. Paul office of the Tri-State Telephone Company. Luncheon was served by the company, and a short talk outlining the development of the telephone industry locally was given by Mr. Williams. There was also a demonstration of the operation of the automatic telephone, a number of instruments being connected up to a demonstrating switch and distributed among the various tables.

The officers of the St. Paul Jovian League for the ensuing year are Clovis M. Converse, Tribune, and A. L. Frankenberger, Second Tribune.

Chicago Section, Electric Vehicle Association.

The meeting of the Chicago Section, Electric Vehicle Association of America on December 1, was given over to an informal discussion of "Operating Costs of Electric Passenger Cars," led by Harry Salvat, of the Fashion Garage. Speaking from the garage standpoint, Mr. Salvat referred to the superior facilities available in Chicago as compared with other cities and to the severe service demands. His experience is that efficient service is of more importance to present passenger-car users than the question of cost. Garage service has become so exacting and specialized that separate attendants are required for battery inspection, outside washing and polishing, window cleaning, upholster cleaning, brass polishing, etc. Mr. Salvat spoke of the low depreciation of the electric as compared with the gas car, referring particularly to some 30 cars in his garage which have been in constant service from 8 to 10 years. He stated in conclusion that if gasoline-car garages would give the same service to gasoline users that electric garages are required to give to the user of the battery vehicle the cost would be from two to four times the present cost of electric-garage service.

December Institute Meeting.

The 302nd meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York City, on Friday, December 11, at 8:15 p. m. The meeting rooms will be opened an hour in advance of the meeting for informal conference of members and guests.

Two papers will be presented at the meeting: "Insulator Depreciation and Effect on Operation," by A. O. Austin, and "Effect of Altitude on the Spark-over Voltages of Bushings, Leads and Insulators," by F. W. Peek, Jr. At the close of the technical session a smoker will be held.

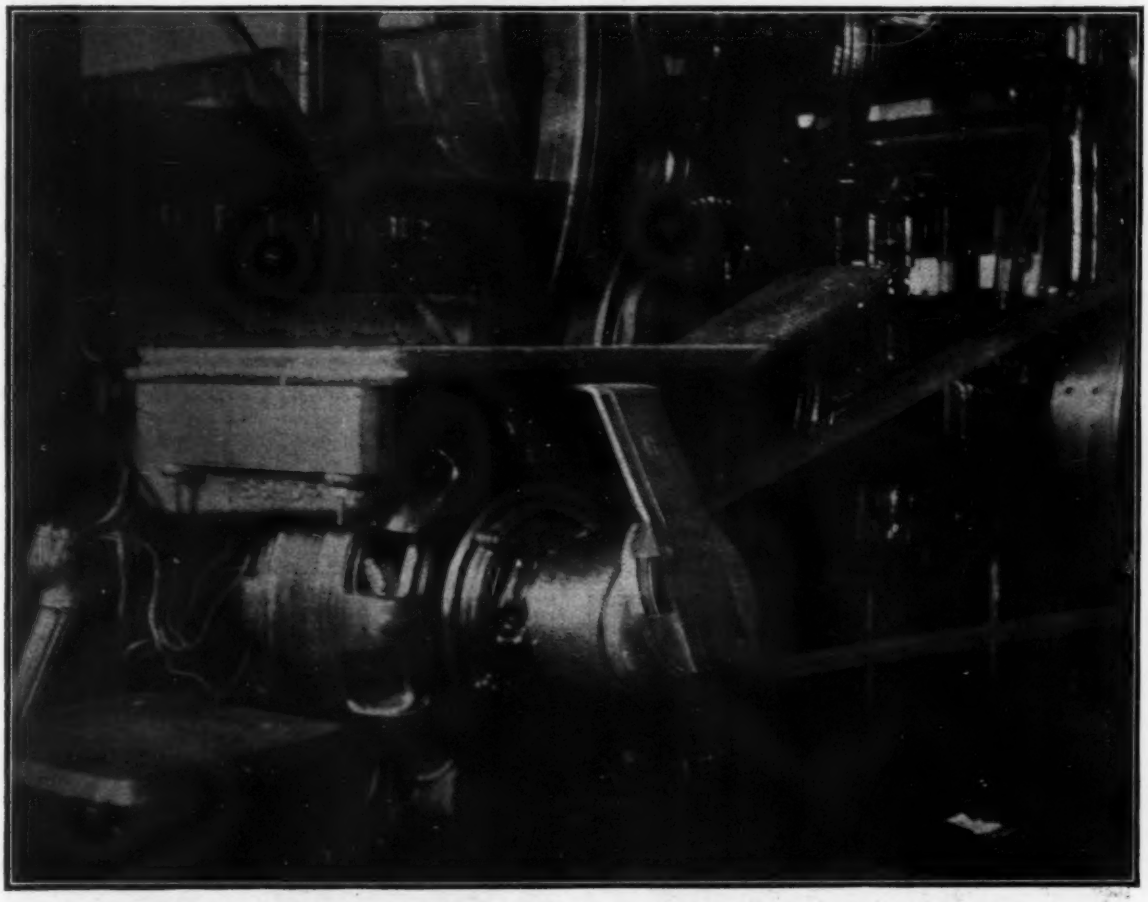
Chicago Jovian League.

At the meeting of the Jovian League of Chicago on November 30, W. R. Rothacher interestingly described the methods of producing motion-picture films, with particular reference to the applications of electricity. He referred to the hazards, financial and electrical, encountered.

Electricity in the Publishing Business.

This article describes the electrical equipment in a modernized publishing plant that has had experience with all types of mechanical and electrical drives. Data are given on the detailed motor installation, together with information respecting control.

A business of 275 years' standing is uncommon, even in New England, but this is the record of the University Press, of Cambridge, Mass., which was established in 1639 by Stephen Day, as a part of Harvard College, and has been in practically continuous operation ever since. The business has been conducted for many years by John Wilson & Son, Incorporated, it having been divorced from the College long ago.



Motor-Driven Cylinder Press With Pulley Protective Device, University Press, Cambridge, Mass.

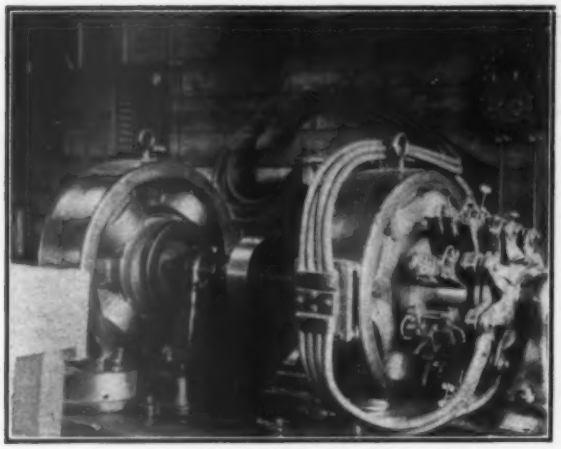
Beginning as it did with hand-set type and hand-lever presses such as Benjamin Franklin used a century later, the establishment is now equipped with the most improved type-setting machines and cylinder presses, all of them electrically driven by individual motors.

The University Press does a general publishing business—the composition, electrotyping and press-work of books and pamphlets, but the binding is done outside, except on small work. The building stands on the bank of the storied Charles River, and its ivy-covered brick walls give a classic setting to what is a thoroughly up-to-date industrial plant.

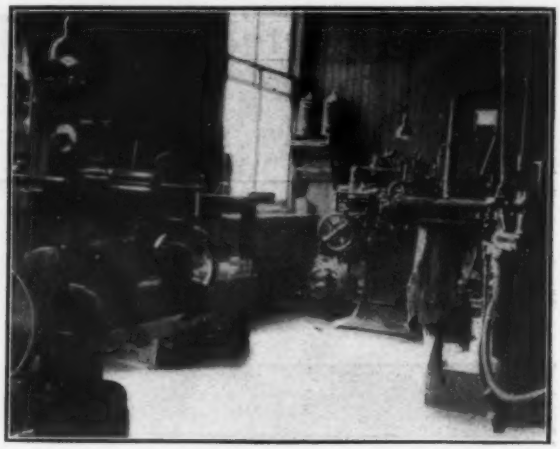
About 300 persons are employed, under most favorable conditions of daylight and air, while the illuminating provision for after-dark work consists of about 700 Mazda incandescent lamps of 25 to 100 watts, installed on shop-made adjustable brackets over the type frames, and in close metal, aluminum-painted refractors over the stones and presses.

The lighting equipment is operated on 110 volts alternating current, and the motors on 500 volts direct current, both supplied by the Cambridge Electric Light Company, whose generating station on the river about a mile down stream supplies electrical energy to the University city, for street, residence and business uses.

When the present building was erected and equipped about 18 years ago, the Adams cylinder presses, then of an efficient type, were in use exclusively and were gear-driven by individual motors of Lundell make. Now, while 19 Adams presses are retained, with their motor equipment, for special work, 23 cylinder presses of recent make have been installed in the press-room, all of them driven by motors of an improved type. The motors have a speed of from 1,000 to 1,500 revolutions per minute, and by means of short belts are connected with the driving pulleys of the presses. Generally, the motors are located under the "step" of the press, but in the case of the two-color Miehle press the motor is located directly under the press itself. Push-button stop and inching controls are installed on the most re-



Electrotyping Outfit.



Motor-Driven Monotypes.

cently acquired presses, and the Cutler-Hammer automatic controlling apparatus is common to the newer acquisitions, and also the job presses used for cover printing and small work. This apparatus enables the number of impressions per hour to be determined upon, and that speed carried through a run of presswork in a uniform manner, without the feeder's interference.

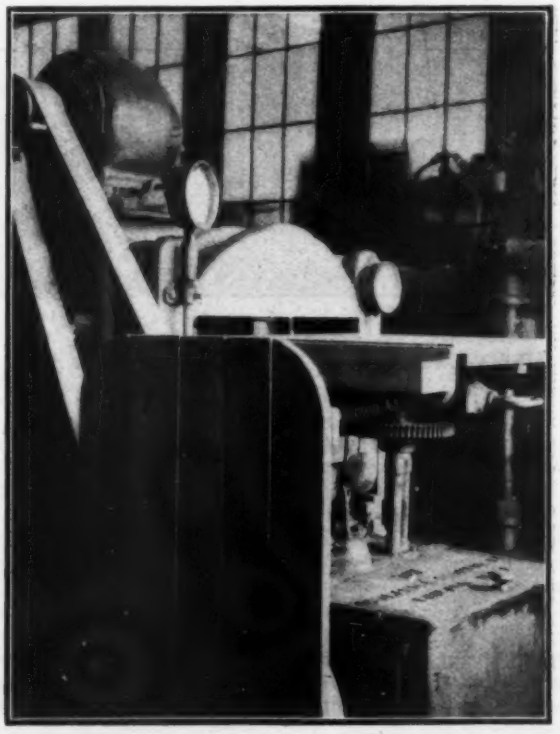
Of the several makes of cylinder presses in use, a test has shown that the Miehle cylinder, because of easier bearings, lighter construction and excellent balance, gave more impressions per kilowatt of energy than any others installed.

Generally speaking, it was found that the Huber press of 33 by 52-inch bed required a motor of about six horsepower. Several presses of this size and make are driven by five-horsepower motors, but the use of at least six-horsepower motors is found to be better practice.

The Press' electrician keeps in reserve an extra armature to fit motors of the five-horsepower Holtzer-Cabot type, of which there are several connected, so that in case of disablement a motor can be speedily rehabilitated, thus entailing slight delay. A spare 7.5-horsepower and a 5-horsepower motor are also kept in reserve, to install temporarily in the event of any of the motors failing. Cork-insert pulleys are being installed on motors where the belt drive is short. It is found that the use of these pulleys saves the slackening of belts, one of them running six months without necessitating the belt being tightened.

In order to provide for power for night work, and to obviate the possibility of delay through motor trouble when the electrician is off duty, besides relieving the single motor operating the air-compressor for monotype keyboard work, a second motor is in place, in line with the first, having a pulley of proper size to give equal speed to the compressor and a shorter length of belt in readiness to connect the reserve

Motor-Driven Paper Cutter, Rheostat Above.



Two-Horsepower Motor Driving 500-Ton Type-Molding Press.

Book Publishing Data.

The University Press, at Cambridge, Mass., employing about 300 hands.
The total connected horsepower is 236. Total number of motors, 79.
The kilowatt-hour power consumption, direct current at 500 volts, was 17,340 for the month of October, an average of 642.2 kilowatt-hours per working day, the Press being run six days a week, eight hours a day, with about 25 per cent of plant operated at night with a 48-hour per week shift. Average kilowatt-hours per month per connected horsepower, 75.82.
Load-factor, 12.8 per cent. Operating-time load-factor, 31 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their hosepower and type. The energy supply is 500-volt direct current procured from the Cambridge Electric Light Company. Contract power rate is: First 5,000 kilowatt-hours a month, $163.58; next 10,000 kilowatt-hours, 1.85 cents; next 35,000 kilowatt-hours, 1.8 cents, net.

No.	Horse-power.	Type of Motor	Application.
1	2	Lundell Shunt	Four Linotypes from shaft.
2	4	Lundell Shunt	Air compressor seven monotype keyboards and five casters; motors operate alternately.
3	0.25	General Electric	Three casting machines.
2	0.25	Holzer-Cabot	Two casting machines.
1	3	Diehl	Standard Automatic-feed high-speed press.
1	2	Lundell Shunt	Four Chandler & Price presses on counter shaft with fly-wheel.
1	2	Lundell Shunt	Superroyal Universal press, 14 by 22-inch bed.
1	2	Lundell Shunt	Superroyal Universal press, 14 by 22-inch bed.
1	2	Lundell Shunt	Superroyal Universay press, 14 by 22-inch bed.
			The three motors above are connected through Cutler-Hammer controllers, giving about 50 per cent speed range.
19	1.25	Lundell Shunt	Forty-four-inch Dexter paper cutter.
1	10	Diehl Compound	Geared to 19 Adams cylinder presses.
1	1	Sprague Compound	Huber-Hodgman perfecting press.
1	4	Lundell series	Operates elevator of pile feeder.
1	4	Lundell series	Babcock cylinder press, 25 by 38-inch bed.
1	5	Compound	Babcock cylinder press, 25 by 38-inch bed.
1	5	Compound	Babcock cylinder press, 33 by 52-inch bed.
1	5	Compound	Babcock cylinder press, 33 by 52-inch bed.
1	5	Compound	Babcock cylinder press, 33 by 52-inch bed.
1	4	Lundell series	Babcock cylinder press, 33 by 52-inch bed.
1	6	C. & C. Shunt	Miehle cylinder press, 34 by 52-inch bed.
1	7.5	Lundell Shunt	Cottrell cylinder press, 41 by 61-inch bed.
1	4	Lundell Shunt	Miehle cylinder press, 41 by 61-inch bed.
1	6	Diehl Compound	Miehle cylinder press, 34 by 52-inch bed.
1	7.5	Diehl Compound	Whitlock cylinder press, 42 by 63-inch bed.
1	5	Compound	Huber cylinder press, 33 by 52-inch bed.
1	7.5	Compound	Huber cylinder press, 33 by 52-inch bed.
1	5	Compound	Huber cylinder press, 33 by 52-inch bed.
1	5	Compound	Miehle cylinder press, 34 by 52-inch bed.
1	7.5	Interpole	Huber cylinder press, 34 by 52-inch bed.
1	7.5	Interpole	Huber cylinder press, 33 by 52-inch bed.
1	10	Interpole	Miehle two-color cylinder press.
1	3	Compound	Campbell cylinder press, 34 by 52-inch bed.
1	2	Lundell Series	Campbell cylinder press, 25 by 38-inch bed.
1	10	Compound	Huber cylinder press, 41 by 62-inch bed.
1	2	Crocker-Wheeler	Five hundred-ton molding press.
1	1.25	Lundell Shunt	One hundred-ton molding press.
1	4	Lundell Shunt	Water pump.
1	1.25	Lundell Series	Shaving machines.
1	1.25	Lundell Series	Distributor and lead pump.
1	1.25	Lundell Series	Blower for cooling casts.
1	15	Holtzer-Cabot	Generator set for electrotype tanks.
1	2	Lundell Shunt	Two routers.
1	1	Lundell Shunt	Side planer.
1	5	C. & C. Shunt	Hoe saw.
1	1.25	Lundell Shunt	Lovejoy shave.
1	4	Lundell Shunt	Lovejoy saw and trimmer.
1	2	Compound	Williams-Lloyd shave.
1	4	Lundell Shunt	Hoe trimming saw.
1	2	Crocker-Wheeler	Hoe type-high surfaces.
1	10	Westinghouse	Freight elevator.
1	2	Lundell Shunt	Bronzing machine.
1	2	Lundell Shunt	Hydraulic pump for dry presses.
1	2	Dooley Series	Paper cutter in basement stock room.
1	6	Shunt	Machine shop.
1	0.25	Holtzer-Cabot	Generator set for telephone and bells.
1	7.5	Lundell Shunt	Spare motor, not connected.
1		Sprague Shunt	Spare motor, not connected.

motor if desired. A double-throw switch controls both motors.

As a means of safety, to protect the workmen and also to keep the dust from the mechanism, particularly in the electrotype finishing room, the rheostats that are in exposed positions are covered with a case made of a disk of fibroid, with a rim the depth of the lever, the handle protruding through the disk. Shop-made metal hoods are provided as a covering protection to the exposed end of the motors, these being constructed of galvanized iron in three pieces, being riveted and soldered at the joints and forming a truncated cone. Pulley guards for the cylinder-press motors are made of strap irons three inches wide, bolted to the under side of the press step and carrying on the lower end and opposite the pulley a circular metal disk, which prevents the pressmen's aprons being caught in passing.

On most of the cylinder presses Chapman electric neutralizers are installed, to remove the troublesome static electricity from the sheets as they are being "run off." This apparatus is found to be of great value beyond the fact that it prevents the sheets adhering together, in that in delivering, the work is deposited on the delivery table in such a manner as to form an air cushion under the newly printed sheet, thus preventing offsetting.

The electrical connection with the neutralizers is from three transformers on the 110-volt lighting service, located on the side of posts in the pressroom, and near the ceiling, which step the voltage up to about 10,000 volts, at which pressure it is carried in small amperages to the various machines through heavy insulated cables installed on porcelain insulators about three inches from the ceiling.

A telephone system with 16 stations is installed throughout the works. A generator operated by a 0.25-horsepower Holtzer-Cabot motor furnishes energy for the system and for electric call bells, and for the push-button throw-off attachment on the perfecting press.

A six-horsepower shunt motor furnishes motive power for the machine shop in the basement, consisting of two engine lathes, an upright drill, planer, shaper, jig and bench saws, and also to two Boston stitchers located on the floor above.

While most of the motors are located on the floor, one which operates a large paper cutter in the basement stock room is installed in an inverted position from the ceiling. The motor operating a second paper cutter used for trimming printed work is encased in a box and the belt likewise encased, so as to prevent paper trimmings being brought in contact. A wise arrangement on this cutter is the placing of the starting apparatus on the top frame of the cutter rather than under the bed, thus giving it a clearer view to the operator and also obviating the danger of possible ignition through sparks coming in contact with inflammable paper waste.

The company's electrical expert has made good use of the still serviceable Lundell motors, in many instances connecting machines with units of this type that otherwise could be motored to good advantage with motors of less horsepower. In these cases the older motors are used mainly on machines that require only intermittent power; hence the added consumption of energy is not a serious consideration.

A Holtzer-Cabot generating set in the electrotyping department supplies six-volt energy up to 1,400 amperes to the electrotype tanks. The two routers which are used in the finishing room are inclosed on three sides with fine wire netting to prevent metal splinters flying. The machines are run from vertical shafts which are connected through a counter shaft to the motor by quarter-turn belts.

A convenient feature of the composing room is a small circular saw, used for cutting leads, reglets and furniture, and driven by a 0.5-horsepower Westinghouse motor attached to the frame.

The Huber-Hodgman perfecting press is equipped with five push-button stops.

A table showing the various motors and their applications accompanies this article.

Motor-Driven Circular Saw in Job Composing Room.

Perfecting Press Driven by a 10-Horsepower Motor.

Commercial Practice
Management, Rates, New Business

CENTRAL-STATION SALES DEPARTMENT ORGANIZATION AND WORK.

By F. D. Beardslee.

Mr. Beardslee, who is sales manager of the Union Electric Light and Power Company, of St. Louis, has an established reputation as a successful and energetic central-station executive. He presents in this article a comprehensive resume of sales department activities as applied in St. Louis and offers to the industry many valuable suggestions.

The organization of a central-station sales department to be successful in its work, must necessarily be built up after carefully considering the local conditions relative to the desires of the public and obstacles to be overcome; therefore, as the writer's experience has been entirely in the city of St. Louis, some of the following comments and information may not be applicable to any other city.

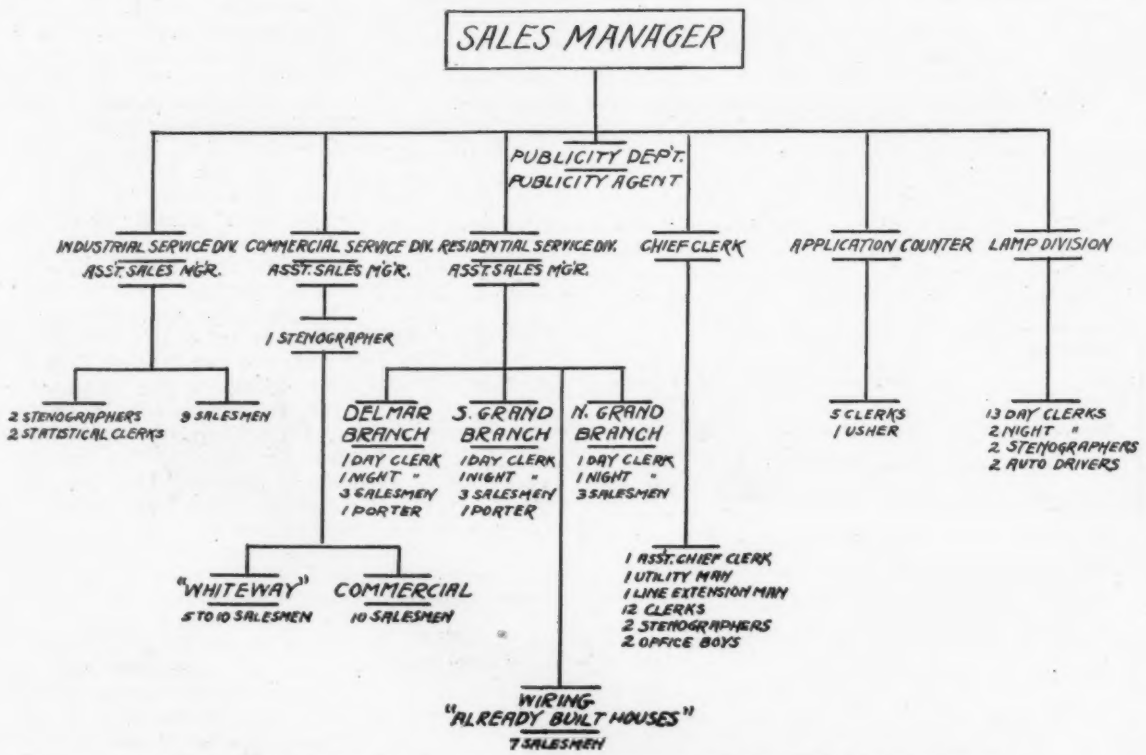


Fig. 1.—Organization Chart of Union Electric Light & Power Company's Sales Department.

The city of St. Louis has an area of 61 square miles: residential section, 46 square miles, commercial section, 15 square miles. From these figures you will notice that 75 per cent of the total area is known as residential and 25 per cent as commercial.

Organization.

Fig. 1 shows organization chart of sales department, from which it will be noted there are seven division heads in charge of the different classes of work, reporting directly to the sales manager.

It is desirable in laying out the work to obtain lighting and power business to decide first how many men it will require to properly cover the city, then divide the city into districts, making one man responsible for his class of work in that district. In this way a man is responsible for the new and old business in that district and he is not interfered with by having another man close some of his business after he has put in considerable work on the prospect.

If a man has been in a district for a year he should be moved to another district and some other salesman transferred to his district. By changing the men in the districts once each year, it will be found that business which the old men considered impossible is obtained by the new men. To explain this more in detail, will cite a case. A man who is familiar with his district is asked to take a new man and break him in. The new man, in passing a certain store, says, "There is a store which should be using electric service in place of gas." The old man says, "That fellow is impossible. I have called on him numerous times in the past, but now waste no time on him." Thus showing that a man, becoming

so very familiar with his district, will unintentionally neglect certain matters where a new man with a different personality could possibly go into the store using gas service and close a contract, accomplishing a thing that the old man considered impossible. It is said, "Fools rush in where angels fear to tread." The new man in this case is far from being a fool, but not being handicapped with past prejudice in the matter, is able to approach the prospect in a different way. Therefore change men once a year, and in case an old man has made a particular friend of some one whom the new man desires to cultivate, it is an easy matter for the new man to call for assistance.

Industrial Division.

It is customary in some cities for the industrial division to have specialists, such as men thoroughly versed in woodworking, refrigeration, etc. We have tried this system but came to the conclusion that this class of men, having a district and being responsible for all the business in that district, obtains a broader knowledge, and in case any one man is more conversant with a certain subject, the district salesman calls him in consultation, in this way obtaining the information and a more general knowledge. When specialists are employed, the men travel all over the city, paralleling each other and no one is responsible for digging up various kinds of business as is the case when each man is responsible for his own district.

It is very essential in handling large jobs to compile carefully all data in connection with the work and also to keep an accurate record of conversations prior to and after the signing of a contract; therefore a folder record is started at the beginning of negotiations and all data are compiled in this folder under the following sub-headings: Proposals and Correspondence; Operating Costs; Equipment Changes; Plant Data; Miscellaneous.

The first sheets of this folder record the name and address of prospect, name of party who should be seen in connection with the work, and following is the date of each call opposite notes made at the time.

In recording the main points of a visit, salesman dictates his notes to a stenographer, who removes the first sheet from the folder, inserting date of call and notes on visit. Two carbon copies of notes are made—one copy goes to assistant sales manager for follow-up; the other copy being sent to the sales manager, and in case he feels that the general manager or any other official of the company could, in a personal way, be of assistance in closing the contract, the copy is sent to the general manager or other official, with proper notations; thus every one interested is kept in close touch with the big jobs.

To emphasize the necessity of an accurate record of this kind, reference is made to a case in mind. The writer when calling on the manager of a large institution, during a period of two years, in trying to obtain a contract for central-station service in place of an isolated plant, was told by the prospect that a year prior, at the time of one of the writer's calls, we had promised to do certain things which we now would not agree to do. The folder was immediately referred to and upon reading the notes regarding the matter under discussion, the prospect was told exactly what transpired at that time, and he stated that if we had made a record of the conversation, no doubt he was mistaken. This folder record is also very convenient in case a prospect should telephone requesting that we call on him, not giving us time to study into the former transactions—we take the folder from file and if possible read over the record of calls on our way to keep the appointment, thus being able to refresh our memory and also to conveniently refer to the papers and data during the conversation.

LIGHT AND POWER CONNECTION DATA
UNION ELECTRIC LIGHT AND POWER CO.
SAINT LOUIS, MO.

C.S. No. _____
DATE _____ 191__
ADDRESS _____ FL. _____ L.S. No. _____
FULL NAME _____ LIGHT / POWER / NEW / ADDITIONAL / SUCCESSOR TO _____
NATURE OF PREMISES _____ TEL. No. _____ METER No. _____
TOTAL LOAD LIGHT _____ Kw.: TOTAL POWER _____ H.P. OR _____ Kw.
DETAIL LOAD LIGHT
H.P. ___ V. ___ C. ___ Ph. ___ Mio ___ M. ___
H.P. ___ V. ___ C. ___ Ph. ___ Mio ___ M. ___
H.P. ___ V. ___ C. ___ Ph. ___ Mio ___ M. ___
H.P. ___ V. ___ C. ___ Ph. ___ Mio ___ M. ___
H.P. ___ V. ___ C. ___ Ph. ___ Mio ___ M. ___
TOTAL MAXIMUM POWER ___ H.P. FOR ___ HOURS / MINUTES
DELIVER _____
SERVICE REQUIRED _____
CREDIT O. K. _____
F. P. S.—O. K. _____
PERMITS APPLIED FOR
WIRING, OLD, NEW, BEING DONE BY _____ OUTLET LOCATION _____
FIXTURES INSTALLED, YES, NO, WHEN? _____
USING SERVICE, YES, NO, WHERE? _____
USED SERVICE, YES, NO, WHERE? _____
ANY WIRING OR FIXTURE WORK TO BE DONE BY U. E. L. AND P. CO.? _____
DISCONNECT OLD LOCATION, YES, NO, WHEN? _____ DISCONNECTION ORDER SIGNED / YES / NO. KEY AT _____
MOVING FROM _____
OWNER OR AGENT NEW LOCATION: NAME _____ ADDRESS _____ KEY AT _____
SEND BILL TO _____
OWNS REAL ESTATE, YES, NO, WHERE? _____
INCORPORATED? _____ WHERE? _____
REFERENCES _____
REMARKS _____
TELEPHONE ORDER RECEIVED BY _____
SALESMAN _____ 9 9 10 11 12 1 2 3 4 5 6

Fig. 2.—Data Sheet Filled Out by Salesman When Contract Is Secured.

Form 420-Rev.

INQUIRY FOR SERVICE.

Name .....
Call at .....
Telephone No. ..... Business .....
Call received ..... 191 .... Time ..... M. By .....
Nature of service wanted { Commercial / Residential .....
.....
Appointment made for ..... (Date) at ..... (Time) A.M. / P.M. @ .....
Disposition .....
.....
.....
By ..... Date ..... 191 .... Time ..... M.

Fig. 3.—Inquiry Slip Used by Clearing House.

The industrial division salesmen have a meeting with the assistant sales manager on each Tuesday and Friday for one-half hour, when the different active jobs are discussed, thus getting the benefit of advice from all the men.

From experience it has been found that if a general salesman is permitted to take contracts for residence and commercial business, one class will suffer, owing to the fact that a salesman will usually take the road of least resistance, bringing in the business which is easiest to obtain and on which he can make the best showing; therefore, if a man must make good by obtaining residence business only, this class of business will not be neglected.

Each salesman has a district and is not permitted to solicit business outside of that district. In case a salesman comes in contact with business in another district, he is instructed to close the contract, but receives credit for only half the value of the order.

Clearing House.

The clearing-house division is in charge of a chief clerk. The work of this division is the keystone of the sales department, and due to the great volume of paper work handled, it is essential that a thorough system be established to permit the passage of contracts and other papers so that delivery of service will not be delayed but expedited.

It would be impossible in this article to cover all the details of this division, but will mention the passing of contracts of the company with data slips (Fig. 2). These data slips are filled out by salesmen at the time contract is taken, and for the purpose of making service connection promptly, salesmen are required to telephone the electrical department, giving full details of data slip, with name and address, so that the detail work in the electrical department starts within an hour or so after contract is signed, thus gaining possibly 24 hours before the contract is delivered to the clearing house and passed to the electrical department. When a contract reaches the clearing house it is checked with the telephone data information and if any errors exist, they are then corrected. It has been the experience that, considering the number of contracts telephoned in, the errors are a very small percentage of the total. After connection is made contract is passed to the billing department and then returned to the clearing house for final check as to connected load, demand, etc., then placed in file. One copy of data slip is sent to the credit department for rating immediately upon receipt by the clearing house, and if there is good reason for stopping the connection, it can be done before actual work is started by the electrical department.

Residential connections are made without thorough credit investigation at the time; thus it is possible many times to make such connections the same day contract is signed.

The clearing house receives all inquiries for service and same are made out in duplicate on appointment slips, shown in Fig. 3. These inquiries are immediately telephoned to the proper division and followed by the original appointment slip, the duplicate being kept in the clearing house file for follow up purposes and check in case complaint is made that salesman failed to call.

All inquiries covering service connections in accordance with signed contract are handled by the electrical department. Inquiries pertaining to a contract or rates are handled by the clearing house.

This division compiles all tabulated figures pertaining to business handled, also pay roll and other miscellaneous

COMMERCIAL SERVICE AND WHITE WAY SALESMEN.

Monthly Salaries

Start, under	$81.75
At end of 1st yr.	81.75
" " " 2nd "	89.80
" " " 3rd "	65.45
" " " 4th "	72.00
" " " 5th "	78.20
" " " 6th "	87.12
" " " 7th "	91.67
" " " 8th "	96.54
" " " 9th "	100.84
" " " 10th "	105.88

Monthly Payments for Merit COMMERCIAL.

1st	$40.00
2nd	30.00
3rd	20.00
4th	10.00
5th	5.00

Monthly Payments for Merit WHITE WAY.

1st	$25.00
2nd	20.00
3rd	15.00
4th	10.00
5th	5.00

HANDICAPS AND MINIMUMS.

Districts	1	2	3	4	5	6	7	8	9	10
COMMERCIAL Handicaps	100	40	80	90	85	160	25	25	30	-
Minimums	200	140	180	190	185	200	125	125	130	100
RESIDENTIAL Handicaps	110	100	55	-	40	20	20	55	10	-
Minimums	210	200	155	100	140	120	120	155	110	-
INDUSTRIAL Handicaps	100			175						
	100	100	125	100	100	80				

all men in these districts.

INDUSTRIAL SERVICE SALESMEN.

Salaries based on efficiency and districts handicapped as above. Merit Points same as Commercial Service Salesmen with the following exceptions:-

For each new contract - personal or office--5 points
For each K.W. capacity secured replacing isolated plant ----------1½ "

Monthly Pay'ts. for Merit- 1st.$15.00, 2nd,$10.00,3rd. $5.00.

RESIDENTIAL SERVICE SALESMEN.

Monthly Salaries

Start, under	$81.75
At end of 1st yr	81.75
" " " 2nd "	84.33
" " " 3rd "	87.04
" " " 4th "	89.89
" " " 5th "	92.78
" " " 6th "	95.91
" " " 7th "	97.55
" " " 8th "	99.23
" " " 9th "	70.96
" " " 10th "	72.73

Monthly Payments for Merit

1st	$15.00
2nd	10.00
3rd	7.50
4th	5.00

MERIT POINTS.

For each NEW BUSINESS CONTRACT on Office call.... (Not additional).....3
" " " " " on personal call (Not additional).....6
" " SUCCESSORS " 2
" " K.W. CAPACITY, New Business & Additional.1
" " $100.00 ESTIMATED YEARLY REVENUE.....3
" " KILOWATT CAPACITY connected on appliance sales.....6
For each SUGGESTION for good of the service, which is adopted.....10
For each WHITE WAY LAMP ORDER SECURED.....6
" " " " " " replacing a gas arc.....10
For each WHITE WAY LAMP ORDER replacing nernst lamp..... 9
For each WHITE WAY LAMP ORDER replacing an electric arc.....10
For each order secured replacing nernst lamp with tungstens..... 3

APPLICATION & LAMP COUNTERS.
Main Office & Branches.

SALARIES based on efficiency.
MERIT POINTS: for each $10.00 Appliance Sales.....3
MONTHLY PAYMENTS FOR MERIT;
1st, $5.00, 2nd $3.00, 3rd $2.00

NOTE--No merit payment to any individual, unless he or she has obtained 9 or more points during the month.

MERIT POINTS.

For each NEW BUSINESS CONTRACT on Office call... (Not additional).. 3
" " " " " on personal call (Not additional).. 6
" " SUCCESSORS " 2
" " CONTRACT TO WIRE OLD HOUSES..... 10
" " K.W. CAPACITY, New Business & Additional..... 3
" " $100.00 ESTIMATED YEARLY REVENUE..... 3
" " KILOWAT CAPACITY connected on appliance sales..... 6
" " SUGGESTION for good of the service, which is adopted..... 10

DEMERIT POINT SCHEDULE.

Failing to attend to any matter promptly	10 points
" " " " " " (after second notice)	25 "
" " " " " " (after third notice)	Discharge.
Failure to telephone contract to office	No points allowed.
" " " " " " (after first caution)	25 points
" " " " " " (after second caution)	Discharge.
Failure to supply information on Successor or Change of Rate Contracts relative to Commencement of Service, for each case,	10 points.
Failure to take discon.nection order for old location when taking a contract for new location, for each case,	10 points.
For taking New Business Contract at a location where our service is not available, without authority from office, for each case,	50 points.
For each general case of inexcusable error or inattention to work, demerit points will be determined by office,	

Fig. 4.—Schedule of Salesmen's Salaries and Merit Points—Union Electric Light & Power Company.

NAME
CLASS
YEAR GRADE

UNION ELEC. LIGHT & POWER CO.
SALES DEPARTMENT
EDUCATIONAL COURSE—ANALYSIS

IN GENERAL

Neatness		Industry		Enthusiasm		Analysis	
English		Thoroughness		Tech. Ability			

KNOWLEDGE OF SUBJECTS STUDIED

REMARKS

A—VERY GOOD B—GOOD C—FAIR D—POOR

Instructor Date

Fig. 5.—Record Card for Class Rating of Salesmen.

paper work in connection with the sales department.

Department Meetings.

To keep division heads closely in touch with all details of their respective divisions and improvements that may be made, and the sales manager closely in touch with the entire department, it is necessary to have meetings, as follows: (1) Each division head has a meeting with the employees in his division, the division head presiding, with a secretary to keep the minutes of meetings, on the tenth of each month, for one hour, after office hours. (2) The division heads have a meeting once each month from 4:30 p. m. until business is finished, sales manager presiding, with secretary to keep the minutes of the meetings.

In this way matters for the good of the service are brought up by employees with the division heads, and at that time provisions are made to immediately rectify any trouble or adopt beneficial suggestions, or are taken up by the division head at the division heads' meeting and there discussed, and if a question is of enough importance and possibly affecting the policy of the company, it is taken up by the sales manager at the staff meeting, presided over by the general manager.

This arrangement speaks for itself and the benefits derived can be appreciated without further explanation.

Sales Meetings.

Regular meetings are held each Saturday from 12:00 m. to 1:00 p. m., all salesmen and division heads being in attendance. At these meetings items of general interest which have been found during the week are discussed and also special instructions for salesmen are given verbally, so that a thorough discussion and understanding may be had. From time to time representatives of different manufacturing concerns address the meetings on certain subjects, such as fans; cost of building construction for motor-driven versus steam-driven machinery; application of motors to woodworking and other industries; nitrogen-filled lamps; and various new appliances.

The officers of these meetings are chairman, vice-chairman, and secretary, and are elected by the salesmen the first of each year.

Merit System For the Payment of Salaries and Commission to Salesmen.

More than a year ago, in analyzing the work done by the salesmen, it was felt that some men were receiving more compensation than they should and others not enough; therefore, for the purpose of more equitably paying for service rendered, a schedule (Fig. 4) was gotten out on a merit point basis.

From the chart shown it will be seen that salesmen's salaries increase in accordance with length of time they have been with the company. In addition to this, there are monthly bonuses paid to the men obtaining the greatest amount of business during the month, and as commission a certain amount is paid per point after demerit points are deducted.

The demerit points are charged in

Form 150-A. 2500-5-14.

ORDER FOR WIRING ALREADY BUILT HOUSES
(AND FIXTURES FOR SAME)

....., 191...

UNION ELECTRIC LIGHT AND POWER COMPANY:

Please install wiring, etc., as per details below, and in accordance with price schedule and terms and conditions on back hereof, at premises..... for which I agree to pay.....Dollars ($.....), as follows:

$.....upon completion of work, and $.....on each following monthly bill for electric service, until total amount has been paid in full.

The first payment hereunder shall not be less than ten per cent (10%) of full amount, and the balance shall be divided into .....monthly amounts.

WIRING.

Price Schedule Item No.	LOCATION OF OUTLETS	Net Prices No Discounts
1	One in..... " " ..... " " ..... " receptacle outlet in	On One Floor $17.95
2	One on next floor, in	
3	Total additional outlets @ $1.80	
	@	
	@	
	@	
	@	
	@	

FIXTURES.

Quantity	LOCATIONS	
	@	
	@	
	@	
	@	
	@	
	@	
	@	
	@	
	@	
	@	
	Total Amount,	

The above prices include fee for customary inspection.
No fixtures installed without order for wiring.

Fig. 6.—Wiring Contract. Rate Schedule is on Reverse Side.

cases where salesmen report incorrect addresses, thus causing the company to send its men to the wrong place at a considerable expense; also in cases where salesmen receive certain instructions and fail to carry them out. If a salesman is demerited and cautioned, then makes the same mistake again, he is demerited much heavier, and if the same mistake is made the third time, he is dismissed from the service of the company. It might appear that some salesmen have very few merit points left at the end of the month, but after the first two months this plan was used, comparatively few cases have been found where it was necessary to charge demerits.

Educational Course.

Three years ago, when first applying the demand schedule, it was evident that a salesman should be thoroughly versed in mathematics and rate schedules to be able to properly inform consumers regarding same; therefore, there was instituted classes which have grown in size and subjects.

The educational work of term 1911-12 was continued the past winter. The large number of students in the primary class made it necessary to divide this class into two. This made a total of four classes this year as compared with one class in the initial season and three last year. Primary class has an enrolment of 36; intermediate, 14; junior class, 13; senior class, 9; making a total enrolment of 72. The original plan of holding the class meetings every Saturday afternoon was changed when the classes resumed work the beginning of October, 1913, and the sessions are now held on alternate Monday evenings and alternate Saturday afternoons of the same week.

The school year is divided into three two-month terms, beginning with the first class day in October, December and February. Examinations are held at the expiration of each term, and any promotions or demotions that may be deemed necessary are made then. The primary class has been instructed in elementary arithmetic and the application of the residence rate schedule; the intermediate class has been taken through arithmetic and given instructions in the application of the company's commercial light and power schedules; the junior class has been given all the terms and conditions of the rate schedules; and the work of the senior class has included the correct application of various types of motors, definitions of electrical terms, wiring costs, as well as the use of central-station service for ice-making, laundries, woodworking, etc.

When it is found necessary to fill a position in the sales department, records of the educational classes are examined and men are promoted according to their class rating. (See Fig. 5.) If an industrial-power salesman is required, we refer to records of class No. 3, junior, and from these records it is easily ascertained whether or not any member of that class is capable of passing an examination for promotion to class No. 4, senior, and take on industrial-power engineering work.

All new men are placed in class No. 1 temporarily, and if they can move to class No. 2, intermediate, within first year, they are advanced two years in the service of the company, which means, as per schedule, an increase in salary. Thus a new man, if more capable than one of the older employees, may go ahead and not be held down by any of the men who have been with the company a longer time.

Curriculum.

Class No. 1—Primary.
1. Mathematics.
2. Elementary Electrical Terms.
3. Electric Lamps.
4. Electric Appliances.
5. Appliance of Mathematics to Rate Schedules.
6. Human Element of Salesmanship.
7. Lectures on above subjects.

Class No. 2—Intermediate.
1. Review work of Class No. 1.
2. Electrical Terms.
3. Uses of Electricity for Residences.
4. Interior Electrical Construction for Residences.
5. National Fire Underwriters' Rules.
6. Overhead Distribution.
7. Residence Rate Schedule.
8. Selling Electric Service.
9. Meter Reading and Billing.
10. Commercial Rate Schedules.
11. Lectures on above subjects.

Class No. 3—Junior.
1. Review work of Classes 1 and 2.
2. General Rates and Schedules.
3. Contract Forms and Riders.
4. General Information for Salesmen.
5. Lamps and Illuminating Engineering.
6. Underground Distribution.
7. Motors and Application of Same.
8. Selling Electric Service.
9. Lectures on above subjects.

Class No. 4—Senior.
1. Review of work of Classes 2 and 3.
2. Basis of Rate Making.
3. State Public Utility Laws.
4. Characteristics of Motors and Service for Same.
5. Isolated Plants.
6. Water Power Service.
7. Industrial Power.
8. Selling Electric Service.
9. Lectures on above subjects.

Clipping Bureau.

To obtain early information relative to prospective business, a clipping bureau should be organized, whose duty it is to obtain from daily papers and the city recorder's office, reports of new projects, leases, transfers, etc., pasting the articles on a slip of paper and forwarding same to the proper division for attention. From this service we have been able to trace many contracts. At one time we tried a similar service furnished by outside concerns, but find by doing the work ourselves, we obtain the information more quickly.

Record of Results.

To properly analyze the work done by various salesmen, it is necessary to have figures compiled showing standing of each man and the amount of business he obtains, and comparative record of contracts taken by outside salesmen and office, showing whether or not the salesmen are active and getting the business before the prospects have time to call at the office.

Also data should be compiled to show the total new business secured. From this tabulation you will obtain the annual revenue per new business contract, annual revenue in new business per kilowatt, and annual revenue per contract. You can also determine whether or not the revenue and load is increasing or decreasing from one year to another.

Appliance Department.

In some companies the appliance department receives little or no consideration, but it is the writer's opinion that as rates for service are decreasing and efficiency of incandescent lamps increasing, it becomes necessary for central stations to look for other loads to help fill the gap, and also to aid in increasing the load and revenue. This to a considerable extent can be done by the sale of electrical appliances.

Industrial heating is often overlooked, but the matter is now being thoroughly followed up by central stations, and some have been able to obtain the electric furnace business which has an excellent load-factor. In this connection, it might be said that the manufacturers of electric appliances are not always ready to furnish industrial appliances to the satisfaction of the consumer, but no doubt such appliances will be standardized as the business is developed by the central-station interests.

With the demand-rate schedules, where the low step of energy rate is around one cent and the consumer would obtain excess energy over and above his present requirements at the low rate, it should be comparatively easy to have the consumer use electrical cooking appliances; especially is this true in the case of hotels, and if proper missionary work is done, in the near future central stations should have quite a load from this kind of business.

To encourage the use of electrical appliances in residences, architects and contractors should be appealed to and encouraged to run a separate circuit on the first floor of a house for heating and cooking only. This should be put in the specifications, and baseboard or wall receptacles placed at convenient points. Some contractors are now running these special circuits, and where they are installed, it is much easier to obtain orders from the consumer for electric appliance equipment.

Electric appliances, such as radiators, should not be encouraged on high rates, excepting in cases where they are to be used in a small room for

slightly raising the temperature for a short time, as in the case of bath rooms, where it is usually desirable to have the temperature higher than in other parts of the house. If appliances such as radiators are sold for heating a room and a consumer decides that it is not satisfactory, owing to both the price and results, this acts in a way to retard the sale of other appliances which could be used to advantage and economically. The sale of electric appliances, such as irons, is greatly increased if a proper advertising campaign is handled in connection with special features, such as having certain days for a sale under attractive conditions.

Relation of Sales Department to the Public.

As a majority of a company's consumers rarely, if ever, see any other representative from the company than its salesmen, it is especially important that the salesman should be, not only in name but in reality, a representative of the company. Before being able to do this, he must acquire a knowledge of the company's methods of handling its business with the consumer, and in event it is impossible for a salesman to answer knowingly any questions put by the consumer, he should make it his business to see that the customer gets the proper answer and, if possible, to the customer's entire satisfaction. A central-station company's business depends absolutely on the public, and if the general mind of the public is antagonistic towards the company, it means that not only the company fails to obtain the business it should, but the salesman in turn fails to write the business, thus reducing his income. If the salesman is wide awake and alive to his opportunities, he will make it his business in case a consumer has any complaints against the company, to immediately run down the complaint and give the consumer as much of his time as is necessary to adjust matters and make a friend out of an enemy. If every salesman would follow this policy, the public mind would be changed to say kind things about the salesman and the company and the ultimate result would be, even though there is no apparent profit to the salesman at the time, that the salesman would be more successful as to his earning power and, in natural sequence, the company would profit. A company is as friendly with the public, and as successful, as its representatives make it.

It is never advisable for a salesman to emphasize his individuality by saying, "I do so and so," or, "I will do so and so." By saying, "We did so and so," will help to maintain a better feeling throughout the organization. The individual attitude should be such that the salesman will be pleasantly remembered without the "I did it" appearance.

To properly impress a prospect, a salesman should not, in case it is necessary to get further information before answering questions, say, "I will take the matter up with Mr. So-and-So and let you know." This belittles the salesman and gives the prospect the impression that he had better see the man mentioned and carry out negotiations with him rather than to bother with the salesman who is merely acting as a go-between. When it is necessary for a salesman to take matters up with the office for discussion, he should say, "I will look up the information on the subject and see you again." If the salesman thinks his boss could do more with the prospect, he can ask for the assistance.

Fig. 7.—Type of "White Way" Lamp Used in St. Louis.

In talking to customers, a representative should be careful to present his case in such a way that the customer will understand him. Technical terms to one who is untechnical should not be used. Talk to a customer and take care of his requirements so that in case he should again transact business with the company, he will ask for you. By becoming friendly with a customer, you will draw his business and also his friends to you and your company.

In representing the company the salesman must have behind him, in every department in the company, the all important SERVICE.

Relation of the Sales Department to Other Departments.

If the sales department is to be successful in obtaining new business and holding the old, it must have absolute co-operation with other departments, and to obtain this efficiently each department head should advise the head of another department as to errors and suggested improvements if he thinks the other department could be benefited by receiving the information. Such information and suggestions should be given and taken in the proper manner, always understanding that such matters are taken up only for the good of the company as a whole and especially for the good of each department. The head of any department should be glad to receive information which would tend to improve the efficiency of his department. Sometimes such information may rub hard, but if the recipient's department is at fault, the head should be broad-minded enough to receive the information thankfully and immediately take steps to correct any existing irregularities. In this connection it would appear that the best method of handling complaints between departments is to have the department heads get together and adjust matters to the satisfaction of those concerned. All such matters should be taken up in an earnest, but not an unfriendly, attitude. always having in mind the slogan, "All together all the time."

Development of Electric Sales.

Before business can be developed it is of course necessary that a salesman be able to present his case in a clear and concise manner. It is also a well known fact that the salesman should make a good appearance, and to do this it goes without saying that his clothing should be neat and clean. J. Pierpont Morgan has been quoted as saying, "If I was down to my last dollar and out of work, I would go to the nearest store, buy a silk tie and then look for a job."

When it is necessary for the salesman or other employee to purchase anything for his own use, he should be careful to let the party from whom he is buying know that he is a representative of the central-station company, and in event the party is not a consumer, he should use his purchases as a lever to obtain the party's light and power business for the company. If the party is a consumer, it is well to let him know that the reason you are buying from him is because he is a customer of your company, and at the same time it may be possible to make suggestions for improvement in the service. The salesman should always make his purchases from the company's customers.

The company's purchasing department can aid materially in the development of business, provided the sales department will keep the purchasing agent posted relative to the company's present and prospective customers.

In developing business, "Already Built" houses should not be overlooked. While this is apparently one of the hardest classes of business to obtain, it will be found that a great many connections can be made if a proper campaign is laid out. In the begin-

ning, advertisements should be worked up to appear on different dates during a season when people are moving and remodeling. After several months of work with a committee representing the electrical contractors, announce a schedule for wiring, so that prices can be made without going over the house for the purpose of making estimate. Contracts for wiring are taken by the company, and jobs are then sub-let to the contractors. A list of contractors is on file in the company's office and in rotation each contractor receives approximately one hundred dollars' worth of work. Thus the work is distributed equally among the many contractors. In this co-operative work, some of the contractors have employed men who do nothing but solicit this class of business. If a wiring contractor is responsible for the receipt of a wiring contract, the job is immediately sub-let to that contractor without affecting the business he will get in his turn. The company should maintain a special crew of "Already Built" house-wiring salesman. Fig. 6 shows the form of contract.

It will be noticed that the price for wiring and fixtures is very reasonable. The items, in addition to the first charge of $17.95, are figured low, owing to the fact that there should be no overhead charges added, as all the fixed or overhead charges are included in the first charge of $17.95. This is worked out along the same idea as demand and energy charge for service.

At a time when rates for electric service were higher than they are today, gas companies made considerable headway by installing the so-called gas arc lamps, both inside and outside of consumers' premises. To overcome this and at the same time to increase the load there has been worked out a plan to install electric light in place of gas lamps.

The reflector shown in Fig. 7 is of white-enameled steel used by the St. Louis company, and permits the light rays to be seen up and down the street; thus making the outfit more attractive to the customer than some reflector entirely housing the lamp. About 9,000 of these lamps have been installed in St. Louis, displacing many gas lamps and preventing many others being installed, at the same time increasing the central-station load.

By installing these 250, 400, 500, 750 or 1,000-watt White-Way lamps in or on an existing consumer's premises, under the rate schedules usually applied by central stations, the consumer will receive a lower average rate per kilowatt-hour, due to the increased consumption and high load-factor of these units.

An aid in securing this class of business is to furnish each salesman with an attractive leather-covered binder holding numerous photographs of prominent installations, also photographs showing night views of streets illuminated by these units installed in front of stores.

To aid in giving prompt service it is well to use a tag, which calls the prospect's attention to the fact that prompt service may be had by applying to the central-station company. This tag should be tied to meter or meter loop when disconnection is made or meter removed; also, the tags should be carried by all salesmen, and used freely.

There are many difficulties encountered in securing business but there is rarely any difficulty which cannot be overcome by the use of a broad mind and good judgment, with the application of the slogan, "All together all the time."

Advertising Electricity in South American Cities.

The Sociedad de Electricidad de Rosario, which supplies the city of Rosario, Argentina, with electric light and power, recently opened a so-called "oficina de propaganda," or advertising office. The company has rented a large store in one of the principal business streets solely for the purpose of advertising electricity and familiarizing the public with its various applications. The company does not sell apparatus or appliances of any kind, although a great variety of articles are exhibited and explained by practical demonstration in the new branch.

The exhibit has been well prepared and charts show at a glance just what can be accomplished with a stipulated amount of current at a stipulated price by using the different appliances. Among articles exhibited are electric fans, drying apparatus, toasters, flat irons, curling irons, tea and coffee pots and other kitchen utensils, cigar lighters, stoves, motors for sewing machines and other household and industrial uses, etc. Electric fans and motors are already well introduced in Rosario. There is a small market for electric stoves, and when business picks up again, the activity of the Sociedad de Electricidad will probably lead to an increased demand for electric appliances of other descriptions.

The Edison Electric Illuminating Company, of Boston, has made a contract with the Plymouth Rubber Company, Canton, Mass., for the supply of electrical energy equivalent to about 1,600 horsepower for 24 hours per day service, for the operation of its plant. Heretofore the company has operated its factory by electricity generated in a private plant. The new contract amounts to about $40,000 a year.

Christmas Electric Appliance Campaign in Louisville.

The Louisville Gas & Electric Company, working through five of the principal dealers in electrical appliances in Louisville, Ky., has begun its Christmas campaign to place numbers of electric devices in Louisville homes, The coupons, referred to previously, calling for a $1 discount on every $3.50 electric iron or every $3.50 electric toaster, have been mailed out to all the electrical subscribers of the company. This is through an arrangement Robert Montgomery, manager of the commercial department of the company, has made with the dealers, by which the whole cost of the campaign, except only that of printing the coupons, falls upon the electrical houses concerned.

In connection with the campaign Mr. Montgomery is arranging a special display of electrical appliances in the display room of the electric company's offices. The articles to be used in the display are all being supplied by the dealers. This display room for some time has been filled with gas appliances, in connection with a gas heating campaign the company has been boosting, but all these heaters are to give way to electrical displays. One of the features of this display will be a huge Christmas tree, electrically lighted and adorned with the various types of electrical appliances which are considered suitable for electrical Christmas presents.

Another feature of the display will be a model dining room in charge of a saleswoman, who will give continuous demonstrations of electric toasters on the market, and serve hot buttered toast to all comers. It is believed by Mr. Montgomery and the electrical appliance dealers of the city that the Louisville public is sufficiently well acquainted with the electric flat iron so as not to require any further advertising of a special nature, but the toaster has been somewhat slow, and some special effort is required to popularize it.

Byllesby Properties New-Business Increase.

Electric generating and distributing properties operated by H. M. Byllesby & Company for the week ended November 13, reported net gain in connected load of 552 customers, with 380 kilowatts of lighting and 81 horsepower in motors. New business placed under contract but not connected in the week included 896 customers, with 493 kilowatts of lighting and 252 horsepower in motors. Output of the properties for the week was 8,074,764 kilowatt-hours, an increase of 10.9 per cent over the corresponding week of 1913.

Electric Sign Data

Electrical Advertising.

Commenting editorially on electrical advertising, *Signs of the Times*, in a recent issue says, electrical advertising was once a heart-of-town feature. Now it has jumped out to the outskirts of the city; it has gone further, and blazing forth from atop the lone factory along the trunk line we find the lighted guide-post to some progressive institution that won't stay hid.

Steamships and ocean liners are using electric signs; also trains, wagons and other vehicles of transportation. The perambulating electric sign is becoming as popular as the stationary sign.

Electrical advertising enters the show window, the show cases, the interior and creates the buying desire at the psychological moment. It extends outward into the street, illuminates the facade and store front, and reaches out to give to the public the welcome of the street as well as the welcome of the individual store.

Electrical advertising breathes progress, engenders the municipal spirit, promotes civic pride and speeds the wheels of industry.

It converses with the inner man, engraving the business or civic message indelibly.

An American institution, the electric sign has encircled the globe; it is doing business for the London merchant, for the South African store and is working for the yellow man in Tokio.

There is good reason for this growth, this expansion, this great success of electrical advertising.

There were no natural obstructions to the progress of electrical advertising. The way was clear.

Man has always shunned the darkness. Ever has he worked to produce light. It is a natural human impulse to follow the light. The impulse is as potent to the most cultured as to the least civilized human being.

Again, human education has always followed the picture route. Pictures have always been the greatest educational force. The first advertisement were pictures, the best advertisements today are pictures, and the last and best advertisement will be a picture. Advertising has always followed the picture route.

Electrical advertising is a picture medium.

It is adaptable to the presentation of a picture that creates an impression.

It will present that picture in color. Color is another wand of enchantment for the human being, irrespective of his degree of civilization. Color attracts and holds the attention.

The electric sign will also present that picture in motion. Motion is another irresistable force of attractiveness.

So that electrical advertising is a medium of pictures, pictures with color, pictures with motion, hence the compulsory attraction of electrical advertising.

Sign manufactured by the S. I. Brin Sign Company, of Minneapolis, and equipped and wired by Sterling Electric Company.

Sign measures 36 feet high by 15 feet wide. The torch is 42 feet high.

Sign contains 3,300 five-watt lamps.

Flashing is accomplished by a 35-point flasher.

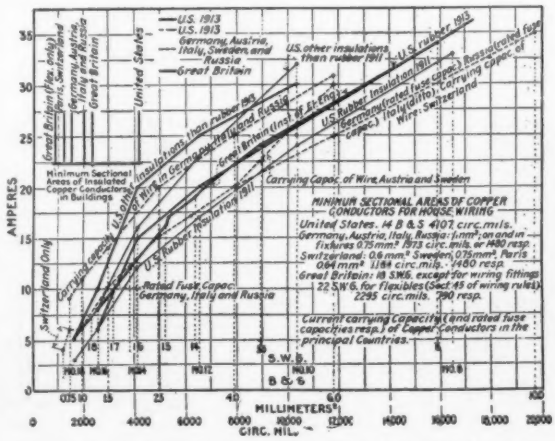
One of the spectacular signs of Broadway, New York, is that recently erected on the roof of the Hermitage Hotel for the Channell Chemical Company, advertising O-Cedar mop polish. The sign is 50 feet high by 90 feet long and shows a woman using a mop. The wording burns steadily and reads "Cleans As It Polishes." Ten-watt tungsten lamps are used throughout the sign.

The O. J. Gude Company, of New York, installed the sign, which is claimed to be distinctly visible for over a half mile in the busiest night center in the United States.

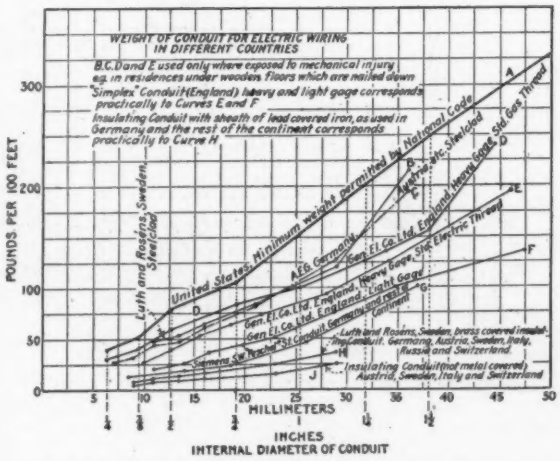
National Electrical Code Wiring Rules Compared with the German and English Rules.

A Parallel Between the United States, German and British Wiring Rules with Two Curve Sheets for Comparing the Requirements of the Three Countries.

There has been some considerable speculation recently with regard to the relation of the wiring rules prescribed in the National Electrical Code to the matter of accelerating the installation of electrical material. The Committee on Wiring of Existing Buildings of the National Electric Light Association, R. S. Hale, chairman, has had under consideration suggestions for the greater safeguarding of electrical installations, together with a possible simplification of wiring rules and the work of inspection of electrical installations in this country. Reference has already been made to the activity of the Committee on Wiring of Existing Buildings in the November 21 issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. In this connection the comparison of the wiring rules prescribed in the National Electrical Code with the German and English wiring rules worked out by Hugo Eisenmenger, of the National Lamp Works of the General Electric Company, Cleveland, O., and presented on the following pages, will be found particularly instructive and interesting.


AMPERES
MILLIMETERS²
CIRC. MIL.
MINIMUM SECTIONAL AREAS OF COPPER CONDUCTORS FOR HOUSE WIRING
Current carrying capacities and rated fuse capacities resp. } of Copper Conductors in the principal Countries.

Current-Carrying Capacities of Conductors in the Principal Countries.



Weight of Conduit for Electric Wiring in the Principal Countries.

Essential to an analysis of the parallel are the two curves published herewith. These relate respectively to the "current-carrying capacities of copper conductors in the principal countries" and "weight of conduit for electric wiring in different countries." The parallel is extended only to such paragraphs of the National Electrical Code as refer to inside wiring of ordinary kind such as in residences and ordinary stores, but not to such places as mills or factories where the wire is exposed to mechanical injuries or chemical influences, etc. Installations in moist rooms and near especially inflammable stuff are taken into consideration only in a few special instances.

The layout of the parallel is made in the following way: The American National code is quoted in the first column and in the second and third columns are those German and British rules side by side which cover the same ground as the respective American rule. When there is an American rule without any parallel foreign rule the spaces in the second and third columns simply remain empty. The American paragraphs compared are paragraphs 16, 18, 19, 23, 24, 26 and 28-32. Those left out between have no reference to ordinary inside installation.

The rules used for the purpose of the parallel and for the development of the curves referred to in the analysis of the parallel include the following:

United States, National Electrical Code; Germany, Vorschriften des Verbandes deutscher Elektrotechniker; Great Britain, Wiring Rules of the Institution of Electrical Engineers; Austria, Sicherheitsvorschriften des Elektrotechnischen Vereines in Wien; Switzerland; Vorschriften des Schweizerischen Elektrotechnischen Vereines; Russia, Rules of the Permanent Committee of the Russian Congress for Electrical Engineers; Italy, Norme per l'Esecuzione é l'Esercizio degli Impianti Elettrici; Sweden, Lag, Innefattande Vissa Bestammelser om, Elektriska Anlaggningar (of June 27, 1902); Paris, Reglement sur les Installations d'Eclairage Electrique (Comite de l'Union des Secteurs Electriques Parisiens).

Comparison of the American Wiring Rules with German and English Rules

United States, National Electrical Code.
Germany, Vorschriften des Verbandes deutscher Elektrotechniker.
Great Britain, Wiring Rules of the Institution of Electrical Engineers.

ALL SYSTEMS AND VOLTAGES—INSIDE WORK—WIRES

UNITED STATES.

16a. Must not be of smaller size than No. 14 B. & S. gage except as allowed for fixture work and pendant cord (fixture low-potential Sec. 26 V. not smaller than No. 18 B. & S.). B. & S. No. 14, 4107 circular mils; No. 18, 1624 circular mils.

16b. Tie wires must have an insulation equal to that of the conductors they confine, and may be used in connection with solid knobs for the support of wires of size No. 8 B. & S. gage or over. Solid knobs or strain insulators must be used for all wires at the end of runs where conductors are terminated. Split knobs or cleats must be used for the support of conductors smaller than No. 8 B. & S. gage, except at the end of runs where conductors are terminated. Split knobs or cleats must be used for the support of conductors smaller than No. 8 B. & S. gage, except at the end of runs. Knobs or cleats which are arranged to grip the wire must be fastened by either screws or nails. If nails are used they must be long enough to penetrate the woodwork not less than one-half the length of the knob and fully the thickness of the cleat, and must be provided with washers which will prevent, under reasonable usage, injury to the knobs or cleats.

16c. Must be so spliced or joined as to be both mechanically and electrically secure without solder. The joints must then be soldered unless made with some form of approved splicing device and covered with an insulation equal to that on the conductors.

16c. cont. Stranded wires (except in flexible cords) must be soldered before being fastened under clamps or binding screws, and, whether stranded or solid, when they have a conductivity greater than that of No. 8 B. & S. gage they must be soldered into lugs for all terminal connections, except where an approved solderless terminal connector is used.

16d. Must be separated from contact with walls, floor timbers or partitions through which they may pass by non-combustible, non-absorptive insulating tubes, such as glass or porcelain, except at outlets where approved flexible tubing is required.

Bushings must be long enough to bush the entire length of the hole in one continuous piece, or else the hole must first be bushed by a continuous waterproof tube. This tube must be a conductor, such as iron pipe, but in that case an insulating bushing must be pushed into each end of it, extending far enough to keep the wire absolutely out of contact with the pipe.

16e. Where not inclosed in approved conduit, molding or armored cable, and where liable to come in contact with gas, water, or other metallic piping or other conducting material, must be separated therefrom by some continuous and firmly fixed non-conductor creating a permanent separation, etc.

GERMANY.

20.3. Insulated wires (in conduit) or on insulators the distances between which do not exceed 1 m (39 in.) minimum section, 1 mm², 1970 circular mils, on and in fixtures, 0.75 mm², 1475 circular mils.

25.2. Multiple conductors shall not be fastened in such a way that the conductors are pressed towards each other. Metal tie-wires are not suited for unarmored multiple conductors.

21i. The joining of conductors and the branching off must be made exclusively by soldering, screwing or an equivalent joint. (Expl. to rule: An equivalent connection would be e.g., a cover of tough metal pushed over the wire-ends and twisted together with them or the riveting connector. Simply twisting the wires around each other is not permissible.)

21.14. Flexibles or cables up to 6 mm² (7638 circular mils) and solid wires up to 25 mm² (31,825 circular mils) may be connected to the apparatus by means of eyes bent out of the conductor. Cables over 6 mm² section (7638 circular mils) or solid wires above 25 mm² (31,825 circular mils) shall be provided with lugs or equivalent joints. Stranded wires and flexibles of any kind shall, as a rule, have the wires of every conductor soldered together at the end if they are not provided with lugs.

21.15. The connections of flexibles among each other and the branches from the same shall be made with screws on insulating bases or equivalent appliances. On and in fixtures soldering is permissible also for flexible wires if the voltage to earth does not exceed 250 volts.

(See 21.14 above.)

24d. The wires must be passed through walls, ceilings and floors in such a way that they are sufficiently protected against humidity, mechanical and chemical injury and conduction along the surface. 24.1. The ducts shall either correspond to the method used in the corresponding localities or durable insulating tubes shall be employed in such a way that for every single conductor or multiple conductor a separate tube is used.

21n. Where current carrying conductors cross each other or cross metal parts these crossings are to be made in such a way that contact is impossible.

ENGLAND.

32. Excepting for wiring fittings the sectional area of any copper-conductor must not be less than that of No. 18 S. W. G. .2291 circular mils).

45. Flexibles must be of a sectional area not less than that equivalent to No. 22 S. W. G. (789 circular mils), and they must be made up of wires twisted together on a short lay, the sectional area of each wire being not greater than that of No. 36 S. W. G. (58 circular mils or .0076" diam.).

33. The minimum size of the conductors within a building will be determined as follows:

(a) For lighting circuits, by the permissible drop in volts, which under ordinary conditions must not exceed 2 per cent plus a constant allowance of 1 volt (figured out in tables).

72. Joints constitute a source of weakness and should be avoided wherever possible. They must be accessible and be mechanically and electrically perfect to prevent heat being generated. They must be soldered except where flexibles are connected to hard wires (see par. 53 below). Soldering fluids containing acids or other corrosive substances must not be used. Connections between conductors should preferably be made in junction boxes.

53. Connections between flexibles and hard wires may be effected only by means of screw terminals in junction boxes, porcelain or other connecting boxes, or ceiling rosetts, and not by soldering; and where flexibles from fittings unavoidably pass into ceilings they must be inclosed in conduits terminating in metal junction boxes.

74, 75, 76 and 77 give further instructions about joints, how the dielectric and braids, etc., should be handled in making joints, etc.

69. Where conductors pass between partitions or under floors, they must be protected in accordance with pars. 49 or 50 or 51 (metal conduit or wood casing or armored conductors). 70. Conductors where exposed to injury, e. g., where passing through walls, partitions or ceilings, they must be inclosed in porcelain or other protecting conduits. 71. Conductors passing through party walls or fire-resisting floor must be provided with special protection, such as a close fitting porcelain or other incombustible tube, to prevent the spread of fire. When the end of the tube is outside the building, it must be bell-mouthed or bushed, and turned downwards.

26. There must be no contact between conductors (or their insulating material, metallic sheathing or tubing, whether earthed or not), and gas pipes. Non-conducting distance-pieces must be used where necessary.

ALL SYSTEMS AND VOLTAGES—INSIDE WORK—WIRES

UNITED STATES.

16f. Must be so placed in wet places that an air space will be left between conductors and pipes in crossing and the former must be run in such a way that they cannot come in contact with the pipe accidentally. Wires should be run over, rather than under pipes upon which moisture is likely to gather, or which, by leaking, might cause trouble on a circuit.

18. Table of allowable carrying capacities of wires—

(See curves page 1081.)

GERMANY.

(See curve sheet.)

ENGLAND.

(See curve sheet.)

SWITCHES, CUTOUTS, CIRCUIT-BREAKERS, ETC.

UNITED STATES.

19a. On constant potential circuits all service switches and all switches controlling circuits supplying current to motors or heating devices and all fuses unless otherwise provided* must be so arranged that the fuses will protect and the switches disconnect all of the wires.

*Exceptions as to switches, motors of ¼ hp or less and heaters of 660 watts and less where single-pole switches are permitted; exceptions as to fuses. In 23a. fuses may be omitted in grounded neutrals, provided the neutral is of equal carrying capacity to the larger of the outside wires.

19b. Switches, cutouts, etc., must not be placed where exposed to mechanical injury nor in the immediate vicinity of easily ignitible stuff, etc.

19c. They must, when exposed to dampness, either be inclosed in a moisture-proof box or mounted on porcelain knobs. The cover of the box must be so made that no moisture which may collect on the top or sides of the box can enter it.

GERMANY.

11d. All switches for current consuming devices must, when opened, disconnect all poles of their circuit which are under tension against earth.

Low-voltage switches (250 volts to earth) serving smaller groups of incandescent lamps are not subject to this rule. 11.3. As smaller groups of incandescent lamps are counted such groups as do not have to be fused with more than 6 amp. (par. 14.7) and do not contain more than 15 lamps in multiple.

11f. It must not be possible to switch off grounded neutrals otherwise than together with their respective outer conductors (except in such rooms as are intended essentially for the operation of electrical machinery or apparatus, and are ordinarily accessible only to instructed persons.) 14d. Conductors must be protected by fuses or automatic cutouts.

(On purpose definite prescriptions are avoided that fuses must be double pole, but it is universally recognized that every pole must be fused, barring grounded conductors.)

31.3. Apparatus shall, where possible, not be placed in moist rooms if this is unavoidable, care shall be taken to provide particularly good insulation, good protection against personal contact and against the injurious influences of moisture.

ENGLAND.

17. Every system not being an earthed concentric system must be protected by linked main switches or linked switch-fuses under the control of the consumer, and these must be easily accessible and placed as near the generator or the entry of supply as circumstances permit.

22. Where energy is taken from all the conductors of a two-phase or three-phase system, the conductors must be protected, either by an automatic triple-pole circuit-breaker, or by a fuse on each pole in conjunction with a triple-linked switch; or by three switch-fuses.

24. Every subcircuit must be protected on each pole by a fuse.

19. Where one of the main conductors of a system of supply is earthed, no interruption of the current is permitted at any point in a conductor connected to the earthed main, unless a simultaneous break is effected on the non-earthed conductor. No switch or switch-fuse not linked to another switch or switch-fuse on the non-earthed conductor may be inserted in any conductor connected to an earthed main. This rule does not prohibit the use of a disconnecting link for testing purposes or a switch for use in connecting a generator.

20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.

87f. In positions where switches and circuit-breakers are liable to injury, or to contact with goods, they must be further protected by an open-fronted box or other suitable guard.

30. Except where completely inclosed in a metallic casing, no switch, ceiling-rose, cutout plug-connector, or other electrical accessory, may be mounted directly upon any surface liable to become damp, but must, in addition to its own mount, be fixed upon a base block rendered impervious to moisture.

ALL SYSTEMS AND VOLTAGES—CONSTANT POTENTIAL—AUTOMATIC CUTOUTS

UNITED STATES.

23a. Must be placed on all service wires, either overhead or underground, in the nearest accessible place to the point where they enter the building and inside the walls, and arranged to cut off the entire current from the building.

Where the switch required by No. 24a is inside the building the cutout required by this section must be placed so as to protect it.

For three-wire (not three-phase) systems the fuse in the neutral wire may be omitted, provided the neutral wire is of equal carrying capacity to the larger of the outside wires and is grounded.

23b. Must be placed at every point where a change is made in the size of wire (unless the cutout in the larger wire will protect the smaller).

For three-wire direct-current or single-phase systems the fuse in the neutral wire, except that called for under 23d., may be omitted, provided the neutral wire is grounded as provided for in No. 15.

GERMANY.

14d. Conductors must be protected by fuse cutouts or by circuit-breakers.

14e. Cutouts must be placed on all such places where the cross-section of the conductors is diminished towards the place of consumption. The cutout must be situated as close as possible to the place of diminution of cross-section area. * * *

14.6. In case of branches the connecting piece between the main line and the fuse can have a smaller cross-section than the main line if its single length is not more than 1 m (39 in.) provided it is separated in a firesafe way from inflammable objects and provided that it does not consist of multiple conductors.

14f. In case of reduction of cross-section where the preceding cutout protects the smaller cross-section, further cutouts are not required.

14g. Lines which are grounded under regular operation conditions must in general not be provided with fuses.

14.9. The neutral conductors of multiple wire or multiple-phase systems shall, as a rule, not be fused. An exception of this rule is insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral shall be marked as such.

14e. Cutouts must be placed on all such places where the cross-section of the conductors is diminishing towards the place of consumption.

14f. In case of reduction of cross-section where the preceding cutout protects the smaller cross-section, further cutouts are not required.

14g. Lines which are grounded under regular operation conditions must in general not be provided with fuses.

ENGLAND.

17. Every system not being an earthed concentric system (par. 58) must be protected by linked main-switches under the control of the consumer, and these must be easily accessible and placed as near the generator or the entry of supply as circumstances permit.

20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.

24. Every subcircuit must be protected on each pole by a fuse.

20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conduc-

ALL SYSTEMS AND VOLTAGES—CONSTANT POTENTIAL—AUTOMATIC CUTOUTS

UNITED STATES.

23c. Must be in plain sight, or inclosed in an approved cabinet, and readily accessible. They must not be placed in the canopies or shells of fixtures. Link fuses may be used only when mounted on approved slate or marble bases and must be inclosed in dust-tight, fire-proofed cabinets, except on switchboards.

23c. cont. Link fuses may be used only when mounted on approved bases and must be inclosed in dust-tight, fire-proofed cabinets, except on switchboards.

23d. Must be so placed that no set of small motors, small heating devices or incandescent lamps, whether grouped on one fixture or on several fixtures or pendants (not more than 16 sockets or receptacles) requiring more than 660 watts, will be dependent upon one cutout.

By special permission, in cases where wiring equal in size and insulation to No. 14 B. & S. gage approved rubber-covered wire is carried direct into keyless sockets or receptacles, and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1320 watts (or 33 sockets or receptacles) will be dependent upon the final cutout.

Except for signs and outline lighting, sockets and receptacles will be considered as requiring not less than 40 watts each.

All branches or taps from any three-wire system which are directly connected to lamp sockets or other translating devices, must be run as two-wire circuits if the fuses are omitted in the neutral or if the difference of potential between the two outside wires is over 250 volts, and both wires of such branch or tap circuits must be protected by proper fuses. * * *

When 1320 watts are dependent upon one fusible cutout, as is allowed in theater wiring, outline lighting and large chandeliers, the fuses may be in accordance with the following table:

125 volts or less..... 20 amperes
125 to 250 volts..... 10 "

22e. The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 15. * * *

Fixture wire or flexible cord of No. 18 B. & S. gage will be considered as properly protected by 6-ampere fuses.

GERMANY.

14.9. The neutral conductors of multiple wire or multiple-phase systems shall, as a rule, not be fused. An exception to this are insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral should be marked as such.

14.5. In low-tension plants the fuses shall be placed in a location where they are easily accessible to those in charge; it is recommended to centralize them as much as possible.

14.9. The neutral conductors of multiple wire or multiple-phase systems shall, as a rule, not be fused. An exception of this rule is insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral shall be marked as such.

14.1. The capacity of fuses shall be adapted as far as possible to the operating current of the lines and consuming devices which are to be protected. It shall, however, not be greater than is permissible acording to the table of carrying capacities of wires and the other prescriptions of par. 20.

ENGLAND.

tors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.

24. Every subcircuit must be protected on each pole by a fuse.

79. Switch and fuse boards must be so constructed and placed that all their parts which may have to be adjusted or handled are readily accessible.

89f. Fuses must not be placed in plug connectors, ceiling roses, or lampholders.

90. Branch fuses must be grouped together in accessible positions in sight, and they should be symmetrically placed and labelled for each circuit.

From 89b: The use of fuses of the inclosed type is recommended.

89d. The bases must be of incombustible, non-conducting and moisture-proof material.

89e. Unless placed in a compartment specially arranged for the purpose, or in engine-rooms in positions where no danger is likely to arise when a fuse operates, fuses must be provided with covers to retain the fused metal. These covers must be of incombustible material, and must either be non-conducting or of rigid metal lined with insulating incombustible material, and clear of all live parts. Small close-fitting covers must be suitably ventilated.

20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.

89a. No overheating of any part of the fuses must take place when the full current flows continuously.

89b. The fuses shall effectively interrupt the current when a short-circuit occurs, and they must be so proportioned to the current to be carried that no conductor protected by them can be raised in temperature above that specified in paragraph 37 (130 deg. Fahr. for rubber, and 176 deg. Fahr. for paper and fiber. The corresponding "working currents" are given in a table forming part of the Rules). When the working current does not exceed 10 amperes the fuses must be proportioned to interrupt the current before or when the current through the conductors rises to three times the working current; for working current above 10 amperes the fuses must be proportioned to interrupt the circuit before or when the current through the conductors rises to twice the working current. The use of fuses of the inclosed type is recommended. No fuse smaller than one having a working capacity of 3 amperes to fuse at 9 amperes need be inserted in subcircuits.

ALL SYSTEMS AND VOLTAGES—CONSTANT POTENTIAL—SWITCHES

UNITED STATES.

24a. Must be placed on all service wires, either overhead or underground, in the nearest readily accessible place, to the point where the wires enter the building and arranged to cut off the entire current, etc.

GERMANY.

ENGLAND.

17. Every system not being an earthed concentric system (par. 58) must be protected by linked main switches or linked switch-fuses under the control of the consumer, and these must be easily accessible and placed as near the generator or entry of supply as circumstances permit.

22. Where energy is taken from all the conductors of a two-phase or three-phase system, the conductors must be protected, either by an automatic triple-pole circuit-breaker or by a fuse on each pole in conjunction with a triple-linked switch; or by three switch-fuses.

ALL SYSTEMS AND VOLTAGES—CONSTANT POTENTIAL—SWITCHES

UNITED STATES.

24b. Must always be placed in dry accessible places and be grouped as far as possible. * * *

Up to 250 volts and 30 amperes, approved indicating snap switches are suggested in preference to knife switches on lighting circuits. * * *

GERMANY.

11.1. In "low-tension plants" (that is, where the voltage to earth cannot exceed normally 250 volts), the switches shall, as a rule, be snap switches.

ENGLAND

78. Main and distribution switch and fuse boards must be fixed in dry situations. * * *

23. Conductors must radiate from distributing centers and in large systems from these centers to sub-centers.

LOW-POTENTIAL SYSTEMS, 550 VOLTS OR LESS—WIRES

UNITED STATES.

26a. Where entering cabinets must be protected by approved bushings, which fit tightly the holes in the box and are well secured in place. The wires should completely fill the holes in the bushings so as to keep out the dust, tape being used to build up the wires if necessary. * * *

26b. Must not be laid in plaster, cement or similar finish and must never be fastened with staples.

26c. Must not be fished for any great distance and only in places where the inspector can satisfy himself that the rules have been complied with.

26d. Twin wires must never be used, except in conduits, or where flexible conductors are necessary.

26e. Must, where exposed to mechanical injury, be suitably protected. When crossing floor timbers in cellars, or in rooms where they might be exposed to injury, wires must be installed in approved conduit or armored cable, or be attached by their insulating supports to the under side of a wooden strip, not less than one-half inch in thickness, and not less than three inches in width. Instead of the running boards, guard strips on each side of and close to the wires will be accepted. These strips to be not less than ⅞ in. in thickness and at least as high as the insulators.

Protection on side walls must extend not less than 5 ft. from the floor and must consist of substantial boxing, retaining an air space of 1 in. around the conductors closed at the top (the wires passing through bushed holes) or approved metal conduit or pipe of equivalent strength.

When metal conduit or pipe is used the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it unless the conduit is installed according to No. 28* (sections c and f excepted), and the wire is approved for conduit use.

* * * * * * * *

The two or more wires of a circuit each with its flexible tubing (when required), if carrying alternating current must, or if direct current, may be placed within the same pipe.

*Conduit installation throughout.

26f. When run in unfinished attics or roof spaces will be considered as concealed and when run in close proximity to water tanks or pipes will be considered as exposed to moisture.

In unfinished attics wires are considered as exposed to mechanical injury, and must not be run on knobs on upper edge of joists.

GERMANY.

10d. Apparatus must be built and mounted in such a way that a sufficient state of insulation is warranted for the wires to be connected (also at the places where the wires enter) against nearby parts of the building, conductors and so forth.

21g. Insulated conductors may either be placed on the surface on suitable insulators or in pipes.

21.8. Wires and cables shall, as a rule, be laid in such a manner that they can be exchanged against new ones.

21a. Conductor lines in fixed position must be protected from mechanical injury by their position or by a separate protective cover; inasmuch as they are under tension against ground a separate protective cover is always required within reach of the hands, as a protection against mechanical injury.

21.1. For armored lead cables and metal covered wires and cables the metallic cover is counted as protective cover. In case of low tension (max. 250 volts to ground) pipes and conduits are classed as protective cover.

24d. Where crossing walls, ceilings and floors, the wires must be laid in such a way that they are sufficiently protected against dampness, mechanical and chemical injury, and conduction along the surface.

24.1. The crossings shall either correspond to the method of laying used in the respective localities or durable insulating tubes shall be used, one separate tube for every single conductor and for every multiple conductor cable.

21h. In case of wires or cables for single or multiple-phase current, which are covered by iron or protected by iron pipes, all conductors belonging to the same circuit must be contained in the same iron casing unless a dangerous heating of the iron case is prevented in some other way.

ENGLAND.

56. Metal staples must not be used for fixing unarmored conductors.

52. Flexibles may be used under the following conditions:

a. For pendant and portable appliances.

b. For sub-circuits from fuse boxes * * * provided they comply with the following requirements:

I. They must not be carried in positions exposed to injury or out of sight, except in conduits complying with par. 52b ii (following herewith).

II. Where passing directly through division walls they must be protected by incombustible water-tight conduits.

III. They must not pass through floors nor be carried unprotected within 4 feet of the floor level.

IV. They must be firmly supported, and unless protected by conduits they must be attached to insulators. The supports must be spaced not more than 3 feet apart.

V. They must be without joints, except in junction boxes.

70. Conductors where exposed to injury (e.g., where passing out of floors) must be specially protected by stout conduits or boxing.

52b iii. Flexibles must not pass through floors nor be carried unprotected within 4 feet of the floor level.

52b. Flexibles: b ii. Where passing directly through division walls the flexibles must be protected by incombustible water-tight conduits. iii. They must not pass through floors. * * *

25. Where protected from mechanical injury by metal conduits, conductors of opposite polarity may be bunched. * * * If the supply is alternating and the protection iron or steel, the lead and return conductors must be bunched.

SPECIAL RULES FOR OPEN WORK IN DRY PLACES

UNITED STATES.

26g. Wires must have an approved rubber, slow-burning weatherproof, or slow-burning insulation.

26h. Wires must be rigidly supported on non-combustible, non-absorptive insula-

GERMANY.

19.1. Rubber tape permissible (open wiring, rigidly supported wires only) up to voltages of 125 volts (technically pure, unvulcanized para rubber band).

21.10. Rubber tape insulation never to be used under plaster, not even in insulating tubes.

21.9. Insulated open wires must be placed at distances of 1 cm from the wall

ENGLAND.

Outside of the description of the various classes of insulation for wiring in general and the requirements therefor, no special prescriptions are made as to the kind of insulation required for open wiring.

52b. iv. Flexibles must be firmly supported and unless protected by conduits

SPECIAL RULES FOR OPEN WORK IN DRY PL ACES

UNITED STATES.

tors, which will separate the wires from each other and from the surface wired over in accordance with the following table:

Voltage	Distance from surface	Distance between wires
0—300	½ in.	2½

* * * * * * * *

Rigid supporting requires under ordinary conditions, where wiring along flat surfaces, supports at least every 4½ ft.

If the wires are liable to be disturbed, the distance between supports must be shortened. * * *

Must not be "dead-ended" at a rosette socket or receptacle unless the last support is within 12 in. of the same.

GERMANY.

in buildings (low voltage, 250 volts to ground) in open air 2 cm. (⅘ in.).

No regulations are made about the distance between wires, but the quasi-official commentary to the rules says that the distance between wires with knob and cleat work at low tension (250 volts), as a rule, is 5 cm. (2 in.).

25.1. Wires on ordinary insulating rolls on a wall shall be supported in distances of not more than 80 cm (32 in.). If on the ceiling the distances may, in exceptional cases, be chosen greater, according to local conditions.

ENGLAND.

they must be attached to insulators. * * *

54a. Unarmored conductors must be supported in such a manner as to secure the permanent spacing of the conductors from walls, ceilings, and all structural metal work and metal piping.

b. When carrying more than 6 amperes conductors must also be spaced from each other, unless they are of the multi-core or concentric types or lead-covered.

55. Uninclosed lead-covered conductors must be supported continuously, or at intervals sufficiently frequent to prevent appreciable sagging, and must not come into contact with damp or new brickwork or plaster. The lead covering must be connected to earth.

56. Metal staples must not be used for fixing unarmored conductors. * * *

Flexibles: 52b iv. The supports must be spaced not more than 3 feet apart.

No rules for solid wires.

FOR MOLDING WORK (WOODEN AND METAL)

UNITED STATES.

26k. Wires must have an approved rubber insulating covering and must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps to be made in molding. Where branch taps are necessary in molding work approved fittings for this purpose must be used.

26l. Must never be placed in either metal or wooden molding in concealed or damp places, or where the difference of potential between any two wires in the same molding is over 300 volts.

When the electrical construction is being carried out in metal molding, permission will be given to extend these moldings through walls and partitions if the molding and capping are in continuous lengths where passing through the walls and partitions. Metal moldings must not be used for circuits requiring more than 1320 watts of energy.

GERMANY.

25a. Wooden molding is not permissible. (Metal molding is not used in Germany and practically unknown.)

ENGLAND.

50. Conductors (exceping flexibles) insulated as in classes A and B (class A, rubber; class B, impregnated paper or fiber in water-proof sheath, usually of soft metal) may be inclosed in wood casing in dry places, where not buried in plaster or cement nor exposed to moisture, under the following conditions:

(a) Unless efficiently protected from drip, wood casing must not be fixed immediately below, and in no case must touch water pipes.

(b) Conductors carrying more than 6 amperes must be laid singly in separate grooves.

(c) Where the size of the conductor is larger than that of 7/19 S. W. G. (.0086 sq. in. between No. 9 and No. 10 B. & S.) sharp bends must be avoided.

Metal molding not used in England.

FOR CONDUIT WORK

UNITED STATES.

26n. Must have an approved rubber insulating covering and must, within the conduit tubing, be without splicing or taps.

26o. Must not be drawn in until all mechanical work on the building has been as far as possible completed.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:

No. 14 to 0 every 100 ft.

* * * * * * * *

26p. Must, for alternating systems, have the two or more wires of a circuit drawn in the same conduit.

The same circuit must not contain more than four two-wire, or three three-wire circuits of the same system, except by special permission of the Inspection Department having jurisdiction and must never contain circuits of different systems.

GERMANY.

21.10. Rubber tape insulated conductors shall, even in insulating tubes, be laid only on the surface of the wall.

26d. Wire joints within the tubes are not permissible except in fixtures.

26a. Paper tubes must have a metal covering.

21h. In case of wires or cables for single or multiple-phase current which are iron-covered or protected by iron conduit, all conductors belonging to the same circuit must be contained in the same iron covering unless a dangerous heating of the iron sheath is prevented in some other way.

26c. In the same tube only conductors are allowed which belong to the same circuit.

ENGLAND.

49. Conductors (excepting flexibles) insulated as in classes A and B may be inclosed in steel conduits. * * *

(Class A, vulcanized rubber, not rubber tape; class B, impregnated paper or fiber, water-proof sheath of soft metal or the like.)

25. Where protected from mechanical injury by metal conduits, conductors of opposite polarity may be bunched. Where the protecting tubing or casing is non-metallic, lengths of conductors of the same polarity and free from joints carrying small currents for incandescent lighting, from sub-centers * * * may be bunched. If the supply is alternating and the protection iron or steel, the lead and return conductors must be bunched.

FOR CONCEALED "KNOB AND TUBE" WORK

UNITED STATES.

GERMANY.

Since frame houses are unknown in Germany, concealed "knob and tube" work is not employed.

ENGLAND.

Since frame houses are unknown in England, concealed "knob and tube" work is not employed.

FOR FIXTURE WORK

UNITED STATES.

26v. Must not be smaller than No. 18 B. & S. gage (1624 circ. mil.) and must have an approved rubber insulating covering.

GERMANY.

20.3. The smallest permissible cross-section-area for copper-conductors is for wiring on and in fixtures 0.75 mm² (=1475 circ. mil.). * * *

18a. In and on fixtures only conductors with water-tight insulation of a quality suited to the voltage applied are allowed.

ENGLAND.

45. Flexibles must be of a sectional area not less than that equivalent to No. 22 S. W. G. (=789 circ. mil.)* * *

32. Excepting for wiring fittings, the sectional area of any copper conductor must not be less than that of No. 18 S. W. G. (=2291 circ. mil.).

FOR FIXTURE WORK

UNITED STATES.

In wiring certain designs of show-case fixtures, ceiling bulls-eyes and similar appliances in which the wiring is exposed to temperatures in excess of 120 deg. F. (49 deg. C.) from the heat of the lamps approved slow-burning wire may be used. All such forms of fixtures must be submitted for examination, test and approval before being introduced for use.

26w. Supply conductors, and especially the splices to fixture wires, must be kept clear of the grounded part of gas pipes, and where shells or outlet boxes are used they must be made sufficiently large to allow the fulfillment of this requirement.

26x. Must, when fixtures are wired outside, be so secured as not to be cut or abraded by the pressure of the fastenings or the motion of the fixture.

26y. Wires of different systems must never be contained in or attached to the same fixture, and under no circumstances must there be a difference of potential more than 300 volts between wires contained in or attached to the same fixtures.

GERMANY.

18.3. Where the voltage to earth is greater than 250 volts joints and branches in fixtures must be avoided.

18.2. Branch joints in fixtures shall be placed as much together on one point as possible.

The Association of German Private Assurance Companies has required formerly that all fixtures be suspended by an insulating member, with exception of such fixtures which are connected to a grounded neutral; but now this is no longer prescribed.

18a. continued. If the conductors are placed on the outside of the fixture they must be fixed so that they cannot shift and cannot be injured by sharp edges.

18a. continued. Where the voltage to earth is greater than 250 volts the conductors of accessible fixtures must be placed in protected positions.

18b. Where the voltage to earth is greater than 250 volts accessible fixtures are permissible only for direct current and only up to 1000 volts.

ENGLAND.

(No mention is made, however, about the minimum permissible size for wiring fittings, except if it be assumed that the paragraph 45 quoted above refers to the minimum section permissible in fittings. The smallest section mentioned in the table of carrying capacities, which forms part of the rules, is 3/25 S. W. G. (=1145 circ. mils).

As regards the type of insulation permitted for fixtures, paragraph 52 says that flexibles may be used for pendent and portable appliances.

46. The insulating material on flexibles must be pure rubber equal to washed Para rubber of the best quality. Pure rubber insulation is best suited for flexibles intended for use with pendants. Pure rubber must be laid on in two layers, care being taken that the edges of each layer overlap, and the radial thickness of the dielectric must be not less than 20 mils. Each coil of pure rubber flexible must be tested in air for 15 minutes with a pressure of 1500 volts alternating between the conductors at a frequency of 50 to 100.

47. Vulcanized rubber flexible must be insulated with one layer of pure rubber and two layers of vulcanized rubber, and the radial thickness of the dielectric must not be less than 34 mils. Each coil of vulcanized rubber flexible must be tested for 15 minutes with a pressure of 1500 volts alternating at a frequency of 50 to 100 after twenty-four hours' immersion in water and while still immersed.

98. Where possible, the conductors should be carried without joints through the fittings to the lamps. * * *

99. Combined gas and electric fittings must not be used.

100. If disused gas fittings are adapted for electric light, they must be entirely disconnected from the gas pipes.

ARMORED CABLES

UNITED STATES.

GERMANY.

Since frame houses are not in use in Germany, armored cables are practically never employed in residence wiring.

ENGLAND.

Since frame houses are not in use in England, armored cables are practically never employed in residence wiring.

INTERIOR CONDUIT

UNITED STATES.

28a. No conduit tube having an internal diameter of less than ⅝ in. shall be used. (Measurements to be taken inside of metal conduits).

28b. Interior conduits must be continuous from outlet to outlet or to junction boxes or cabinets and the conduit must properly enter and be secured to all fittings, and the entire system must be mechanically secured in position.

In case of service connections and main runs this involves running each conduit continuously into a main cutout cabinet or gutter surrounding the panel-board, as the case may be.

28c. Must be first installed as a complete conduit system, without the conductors.

28d. Must be equipped at every outlet with an approved outlet box or plate. At exposed ends of conduit (but not at fixture outlets) where wires pass from the

GERMANY.

26.3. Conduit which is to be used for more than one wire must have an internal diameter of at least 11 mm. (7/16 in.), and where the voltage is more than 250 volts to earth the internal diameter must be at least 15 mm. (19/32 in.) for such conduit.

26.4. If in wiring not buried in the wall parts of the run are protected by conduit smaller diameters of the tubes are permissible.

ENGLAND.

49a. Conduits must be electrically and mechanically continuous throughout. Plain slip sockets do not comply with this rule,* some form of screwed or grip joint having a conductivity equal to that of the continuous tubing being necessary.

49b. At the outlet points of switches, boxes and fittings, the ends of the conduits must either terminate at metal outlet boxes or they must socket into blocks, preferably of noncombustible material. The conductors must in all cases be mechanically protected up to the fitting.

*Slip joint tubing, however, is being used very largely in England, perhaps 50 per cent of all installations being slip joint.

INTERIOR CONDUIT

UNITED STATES.

conduit system without splice, joint or tap, an approved fitting having separately bushed holes for each conductor is considered the equivalent of a box.

Outlet plates must not be used where it is practicable to install outlet boxes.

* * * * * * * *

28e. Metal conduits where they enter junction boxes, and at all other outlets, etc., must be provided with approved bushings or fastening plates fitted so as to protect wire from abrasion, except when such protection is obtained by the use of approved nipples, properly fitted in boxes or devices.

28f. Must have the metal of the conduit permanently and effectually grounded to water piping, gas piping or other suitable grounds, provided that when connections are made to gas piping they must be on the street side of the meter. * * * Where a short section of conduit * * * is used for the protection of exposed wiring on side walls * * * the conduit or pipe need not be grounded.

28g. Junction boxes must always be installed in such a manner as to be accessible.

28h. All elbows or bends must be so made that the conduit will not be injured. The radius of the curve of the inner edge of any elbow not to be less than 3½ in. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not to be counted.

GERMANY.

26.2 continued. The tubes shall further be provided with appropriate armatures, for instance, bushings so that the insulation of the conductors cannot be injured by protruding parts and sharp edges.

It is required only for voltages of more than 250 volts (to earth) that the metallic conduits be connected metallically to each other and that the conduit be grounded. (26b.)

21.8. Conductors shall, as a rule, be placed in such a manner that they can be replaced.

26.2. With metal and insulating tubes in general the internal diameters, as well as the number and the radius of the curvatures shall be selected in such a manner that the wires can be drawn in and removed. In case of conductors of more than 16 mm² (31,568 circ. mils.) the requirement that the wires shall be withdrawable may be disregarded if the conduit is laid on the wall accessible at any time.

ENGLAND.

49c. The conduits must have all free ends bushed to prevent abrasion except where wide bell-mouths are used.

49d. The conduits must be connected to earth. * * *

28. Gas pipes must not be laid to obtain an earth connection.

49d. (continued): In dry places isolated single lengths of tubing need not be earthed if adequately enamelled, or otherwise insulated, externally.

49g. Sharp bends or elbows are prohibited, but inspection elbows are permissible.

METAL MOLDINGS

UNITED STATES.

GERMANY.

Since metal moldings are not used in Germany, no special rules exist for them.

ENGLAND.

Since metal moldings are not used in England to any extent, no special rules exist for them.

FIXTURES

UNITED STATES.

30a. When supported at outlets in metal conduit, armored cable, or metal moulding systems, or from gas piping or any grounded metal work, or * * * or * * * or * * * must be insulated from such supports by approved insulating joints placed as close as possible to the ceilings or walls. The insulating joint may be omitted in conduit or armored-cable systems with straight electric fixtures in which the insulation of conductors is the equivalent of insulation in other parts of the system. * * *

Gas pipes must be protected above the insulating joint by approved insulating tubing and where outlet tubes are used they must be of sufficient length to extend below the insulating joint. * * *

Where insulating joints are required, fixture canopies of metal must be thoroughly and permanently insulated. * * *

Canopy insulators must be securely fastened in place. * * *

Fixtures having so-called flat canopies, tops or backs, will not be approved for installation, except where outlet boxes are used.

30b. Must, when installed out doors, be of water-tight construction.

30c. Fixtures must not when wired on the outside be used in show windows or in the immediate vicinity of especially inflammable stuff.

30d. Fixtures must be free from short-circuits between conductors and from contacts between conductors and metal parts of fixtures, and must be tested for such conditions before being connected to supply conductors.

GERMANY.

The Association of German Private Fire Insurance Companies has required formerly that all fixtures shall be grounded with exception of those which are connected to grounded neutrals; but now that is no longer required.

18b. If the voltage to earth can rise above 250 volts the metal parts of fixtures must be grounded.

36a. Fixed conductors must, as far as they can come in contact with easily inflammable material, be protected entirely by tubes up to the lampholders or to the receptacles, respectively.

5. Every installation for light, power, etc., must have an appropriate state of insulation.

5.4. The state of insulation of an installation in which the voltage against earth cannot exceed 250 volts will be assumed as appropriate if the loss of current at normal operating voltage on every part between two cutouts or behind the last cutout does not exceed one milliampere. * * *

ENGLAND.

99. Combined gas and electric fittings must not be used.

100. If disused gas fittings are adapted for electric light they must be entirely disconnected from the gas pipes.

101c. Lamp-holders must not be hung from flexibles exposed to the weather.

From 122: * * * When all lamps and appliances have been removed from the circuit, the insulation resistance between conductors must not be less than 25 megohms divided by the number of lamps. * * *

SOCKETS

UNITED STATES.

31c. Key-sockets will not be approved if installed over specially inflammable stuff. * * *

GERMANY.

ENGLAND.

FLEXIBLE CORD

UNITED STATES.

32a. Must have an approved insulation and covering.

32b. Must not * * * be used where the difference of potential between the two wires is over 300 volts.

GERMANY.

The covering and insulation of flexible cord, as well as of the other kinds of conductors, is regulated in separate prescriptions which form part of the general rules.

According to the general standard regulations for insulated conductors flexibles, if laid down in fixed positions, may be used up to 1000 volts, and if used for portable appliances, up to 500 volts.

ENGLAND.

46 and 47 (quoted in full above) give prescriptions about the covering and insulation of flexible cord.

FLEXIBLE CORD

UNITED STATES.	GERMANY	ENGLAND
32c. Flexible cord must not be used as a support for clusters.	18c. If the conductors are used as supports for the fixtures (pendant lamps) the connecting places (terminals) must be relieved of the mechanical stress. (According to the standards for wires the wires for pendant lamps contain a separate carrying cord to take the tensile stress from the current-carrying wires.)	52. Flexibles may be used under the following conditions: a. For pendant and portable appliances. * * * * * * * *
32d. Flexible cord must not be used except for pendants, wiring of fixtures, portable lamps or motors and portable heating apparatus.		52. Flexibles may be used under the following conditions: * * * * * * * * b. For subcircuits from fuse boxes * * * provided they comply with the following requirements: I. They must not be carried in positions exposed to injury or out of sight, except in conduits. II. Where passing directly through division walls they must be protected by incombustible watertight conduits. III. They must not pass through floors nor be carried unprotected within 4 feet of the floor level. IV. They must be firmly supported, and unless protected by conduits they must be attached to insulators. V. They must be without joints except in junction boxes.
For all portable work, including those pendants which are liable to be moved about sufficiently to come in contact with surrounding objects, flexible wires and cables, especially designed to withstand this severe service, must be used. When necessary to prevent portable lamps from coming into contact with inflammable materials or to protect them from breakage they must be surrounded with a substantial wire-guard.	No distinction is made in the rules between ordinary flexibles and flexibles for portable work.	
32e. Flexible cord must not be used in show windows or show cases, except when provided with an approved metal armor. * * *	39. (Special Rules for Theaters). 1. paragr. 4: The fixtures on the stage must be protected by a wire-guard for the incandescent lamps.	105a. Incandescent lamps must not be placed in close proximity to combustible materials unless specially protected. * * * 105b. Incandescent lamps must be fitted with guards if placed in position where goods are liable to be stacked in contact with them.
	36. (Special Rules for Show-windows, Warehouses and similar localities, inasmuch as easily inflammable materials are stored in the same): * * * b. Fixtures and other appliances which can be moved about must be connected either by metal-covered conductors, or by specially protected conductors without metal sheath. In the first case one end of the metal cover must be brought in conductive connection with the metal cover of the lamp holder, the other end must be connected to a grounded conductor. In the second case only flexible cord with watertight insulating cover is permitted which is provided with a cover of tough material (such as canvas, leather, hempen cord braiding, etc.) as a protection against mechanical injury.	
32f. Flexible cord must be protected by insulating bushings where the cord enters the socket. 32g. Flexible cord must be so suspended that the entire weight of the socket and lamp will be borne by some approved method under the bushing in the socket, and above the point where the cord comes through the ceiling block or rosette, in order that the strain may be taken from the joints and binding screws.	18c. If the conductors are used as supports for the fixtures (pendant lamps) the connecting places (terminals) must be relieved of the mechanical stress. (According to the standards for wires, the wires for pendant lamps contain a separate carrying cord to take the tensile stress from the current-carrying wires.)	96c. The terminals of ceiling-roses must be relieved of the direct pull of the attached conductor and fitting, and be so arranged that no short-circuit can take place.

Construction Details of Temporary Motor Installations.

The Department of Electricity, City and County of San Francisco, Cal., has issued an interesting order covering construction details of temporary motor installations. This order has become effective primarily to afford relief to those engaged in installing motors for the operation of pumps, concrete mixers and the like, on buildings under construction. Such class of installation work having heretofore been required in a more or less permanent manner, even on intended temporary operations, has brought about a condition of particular hardship to motor men and others, causing frequent loss of available contracts.

The department will only approve temporary installations of electric motors when executed under the following conditions.

Switch and Cutout.—Motor must be protected by approved switch and cutout installed in such a manner that workmen and passers-by cannot come in accidential contact with same. A metal or wooden box for switch and fuses is recommended.

Wiring.—Current - carrying wires to motors must be approved rubber-insulated double braid wires supported on knobs or installed in conduit and, if on knobs, must be suitably protected at all points where accidental contact is possible by substantial wooden boxing; in any case, to be so protected to a height of eight feet above the ground. In very hazardous installations, wooden boxing will not be accepted in lieu of conduit.

Motor Frame.—Motor frame must be grounded. If no good ground is available, a 15-inch pipe driven into the earth to a depth of five feet will be considered a suitable ground. Wire to ground must be equal in size and conductivity to a No. 10 B. & S. gauge copper.

Wire Capacity.—On temporary installations, the department will approve the use of rubber-insulated new-code wire with the current-carrying values as given in Table B, section 18 of the National Electrical Code. Common return wire on three-wire two-phase motors shall be figured to carry a current 41 per cent greater than the other two legs.

Conduit Ends.—On exposed ends of conduits back of switchboards where it is necessary to cable wires together in order to execute a workmanlike job, approved porcelain-bushed iron bushings will be accepted in lieu of condulets. Hereafter, plain iron bushings will not be accepted on exposed ends of conduit back of switchboards.

National Association of Electrical Inspectors.

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H. S. WYNKOOP, Vice-President, Municipal Building, New York, N. Y.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
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"LET THE CODE DECIDE."

Secretary's Message.

Members will kindly note the following changes in addresses of members of the California Section, all of San Francisco: S. G. Curtis, 612 Central Street; William G. Pennycook, 1335 Sixth Avenue; O. K. Jones, 1261 Seventh Avenue; James Wharton, 1566 Fell Street; J. W. Carrell, 814 Scott Street.

The Secretary regrets to state that his words regarding payment of dues in these columns two weeks ago have not brought a single response. Please wake up as regards this little matter.

All material for the bulletin on proposed Code changes must be in Mr. Sweetland's hands by January 15. Members will kindly read the notice regarding this which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN November 21, page 996, and see that any matter they desire placed therein by the Association is in my hands not later than December 20 at the utmost.

After a very considerable amount of labor the Committee on Field Practice of the National Fire Protection Association has completed its manual on inspection. It is a remarkable publication in more ways than one and cannot fail to be of value to any inspector.

Not a great deal will be found in it of *direct* assistance to the electrical inspector who already has his National Code. Nevertheless the Secretary earnestly recommends every member of the Association to send to Franklin H. Wentworth, Secretary, National Fire Protective Association, 87 Milk Street, Boston, and obtain a copy.

The conscientious inspector will find in it a huge mass of matter very closely correlated to his special province, and a thoughtful perusal of its pages will be of very great benefit to him in more ways than one We must never forget that all the time he is inspecting, the true inspector will be discovering opportunities for education which he should avail himself of, and in many places which he visits things will be found and noticed which this manual will enable him to point out to the owner in a friendly way, which is frequently surprisingly efficacious; assuming, of course, that one knows enough of the subject at hand to impress his victim with the fact that he knows what he is talking about, is able to give an illustration or so and generally point out how the said victim's direct personal interests are concerned.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Three-Circuit Chandelier.

Question 280. Regarding Rule 26p, I have a case where a man wants a three-circuit chandelier switch requiring four wires from switch box to outlet; the job is fished with armored cable. Now four-wire cable is not obtainable. Is it permissible to use two two-wire cables; would it comply with the Code, or what is the objection?

Answer 1(P). Two two-wire armored cables would be approved if direct current is employed. With alternating current, however, recourse must be had to a metallic conduit carrying all four wires.

Answer 2(E). Assuming that an approved box is used at the switch outlet and a similar box at the fixture outlet and that both armored cables are properly secured and bonded at the boxes, I think I would pass the installation and not place any violations on it. If, however, my advice was sought before the installation had been started I would suggest the use of conduit, either rigid or flexible.

Answer 3(N). This cannot be accepted in principle, because under two conditions one wire in each conduit carries current and therefore with alternating current you would expect hysteresis and eddy-current energy waste with consequent heating in the armor. If, however, the installation was, as appears probable, in a private house with only moderate current flowing, as would be the case with the usual size of tungsten lamps used in such small-size chandeliers, I would pass it if already in. This would be on the following grounds; it is possible to connect the wires so as to reduce the current to a minimum under the bad conditions; the metal armor is a much harder grade than in a rigid conduit which must be ductile for bending, and in consequence its permeability is relatively low; it is somewhat thinner, which will reduce the flux, and being in a spiral the circular path round the wire is not continuous but interposes a pronounced air-gap in the path of the lines of force which will to a considerable extent increase the magnetic reluctance. The result of all this being that the bad effects are reduced to a marked degree and except in the case of a large chandelier with considerable current flowing in each position, as might be the case in a theater, church or large hall, practically negligible.

Indeed in any case these impedance effects will always be much less disturbing in flexible steel conduit or cable than in rigid conduit.

Answer 4(H). Use a larger conduit carrying four wires through it under Rule 26*p*.

Answer 5(F). The intent of this rule is to have the feed and return wire in the same conduit. In this case of a three-circuit chandelier switch this condition could not be obtained by using two two-wire armored cables. The work should be installed with the four wires in one conduit, or use an armored flexible tube large enuogh to pull in all four wires.

Answer 6(B). It would depend on whether fixture was to be attached to an alternating or direct-current wiring system. If the former, it would not be permissible under the Code to use this arrangement as described. If direct current were used there would in my judgment be no material objections other than the fact that at some future time alternating-current service might be substituted for the direct-current.

Answer 7(R). For direct current, yes; for alternating current, no; objection, inductive troubles. See Rule 27*g*.

Answer 8(U). I should suggest using flexible conduit and pull in four wires in the same conduit as this could be run as easily as armored cable.

Answer 9(S). I do not think it permissible to use a two-wire pair of cables. Such construction would not comply. I should require flexible conduit, the same being large enough to take the four wires.

The objections are inductive troubles.

Answer 10(V). This practice is not in strict compliance with Rule 26, but on the ordinary domestic lighting circuit no bad effect would result from it. I should allow it.

Answer 11 (A). Rule 26*p* would prevent the use of the two two-wire armored cables, as the effect would be the same as with two parallel pipes with two wires in each pipe. I should think the better way would be to use flexible conduit large enough for four wires.

Answer 12(O). The use of two two-wire cables would violate Rule 26*p*, because of the fact that in two positions of the switch the current will be on one wire of each cable instead of the entire current being in the same metal armor, as required to neutralize any inductive effects. Rigid or flexible steel conduit should be used with all four wires in one tube.

Flexible Steel-Armored Conductors.

Question 281. Is it permissible under the Code to install flexible steel-armored conductors wherever conduit may be used; and if not, what are the exceptions?

Answer 1(P). Flexible steel-armored conductors may be placed wherever iron pipe is permitted; with this difference, however, that in damp locations the flexible cable must be provided with a lead sheath.

Answer 2(E). Armored cable may be installed in all places where conduit may be installed with the following exception, which is in section *d* of Rule 27: "When installed in so-called fireproof buildings in course of construction or afterward if exposed to moisture, or where it is exposed to the weather, or in damp places, such as breweries, stables, etc., the cable must have a lead covering placed between the outer braid of the conductors and the steel armor.

The lead covering is not to be required when the cable is run against brick walls or laid in ordinary plaster walls unless same are continuously damp."

Answer 3(N). Flexible steel-armored cable and flexible steel conduit may be used wherever rigid pipe may be used, except that in the type of places enumerated in Rule 27*d* the armored cable would be required to have a lead sheath under the armor, and lead-covered twin-conductor cable would have to be used in the flexible conduit, though single conductor might be used on purely direct-current systems.

Answer 4(H). Flexible steel armor is a conduit somewhat subject to dampness under the Code.

Answer 5(F). Yes, if properly installed, except in damp places unless the armored cable has a lead covering placed between the outer braid of the conductor and the steel armor.

Answer 6(B). It is permissible under the Code to install flexible steel-armored conduit where conduit may be installed; it, of course, being understood that the provisions of Rule 27, section *d*, be carried out. (See answer 2 above.)

Answer 7(R). Yes, for low-potential systems; but in "General Suggestions" preference is given accessible concealed wiring.

In the highest type of wiring metallic armored installations, rigid and flexible conduit are installed so that wires may be inserted or withdrawn, and armored cable is installed so that it may be removed or replaced without disturbing any finished surface.

Answer 8(U) Yes, except in permanently damp places. Then lead-protected cable must be used.

Answer 9(S). Not always. If armored cables are referred to the exceptions are found in Rule 27*d*.

Answer 10(V). Yes. There are no exceptions, provided the lead covering is used in damp places.

Answer 11(A). Yes (with the lead cover in damp places). That is what it was made for, and I do not think the Code rules would prohibit this.

Answer 12(O). Flexible steel-armored conductors may not be installed in permanently damp places, but otherwise they are generally acceptable wherever conduit may be used.

Answer 13(Q). Armored cables are made for all purposes that interior conduit is used for.

Cincinnati Contractors Oppose Additional Inspection Fees.

The proposal of Building Commissioner Rendigs, of Cincinnati, to render his department self-sustaining by the imposition of various inspections fees not now charged by the city, including an inspection of electrical work, has been met with vigorous opposition on the part of electrical contractors and others who will be affected. Inspection of electric wiring and other work is now made by the Fire Prevention Bureau, and a small fee charged. Presumably this inspection will be dispensed with if that of the city is sufficiently rigid.

Chicago Inspectors to Celebrate Anniversary.

A banquet and entertainment will be given at the Congress Hotel, Chicago, on the evening of Thursday, December 10, to celebrate the thirty-first anniversary of the Bureau of Electrical Inspection of that city. Elaborate preparations for that event are being made by the various committees, of which the following are chairmen:

Refreshments, C. B. Giles.
Entertainment, B. M. Graybill.
Finance, John Finan.
Decoration, L. L. Johnson.
Photograph, E. J. McGann.
Invitation, S. N. Pine.
Souvenirs, Daniel Battle.
Publicity, F. O'Byrne.
Reception, F. Derby.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The City of Los Angeles proposes to acquire the distributing system of the Southern California Edison Company within the city limits of Los Angeles, and in certain adjoining territory, to be used for the distribution of the hydroelectric power which the municipality will develop in connection with its aqueduct. The city authorities propose to acquire the distribution system by condemnation, and in contemplation of this procedure the city has asked the Railroad Commission to fix the compensation to be paid for this property.

General Investigations. The Commission is investigating the rules and practice of all the gas and electric companies of the state in the matter of requiring deposits before furnishing service to consumers. The Commission desires to determine the reasonableness of such a requirement, and to bring about greater uniformity in the practice of the companies, if this can be done with justice to all parties.

DISTRICT OF COLUMBIA.

The Potomac Electric Power Company furnished service under contracts at special rates to certain customers within the District of Columbia. After investigation the Commission found that "though each of the said contracts was made prior to the enactment of the public utilities law, the constitutional provision, which forbids the impairment of the obligations of a contract, was not intended to deprive the Congress of the United States of the authority to exercise its police power in such a governmental matter as the regulation of public service companies in the District of Columbia." The company is ordered to discontinue the special rates and to substitute therefor its established rates, as filed with the Commission.

NEW YORK—Second District.

The Delaware and Hudson Railroad has agreed to restore sleeping-car service over certain routes where it had recently been discontinued. The company was able to show that the service was unprofitable, but the fact that it had become so interwoven with the business and social life of the communities affected by its long continuance caused the Commission to insist strongly on its restoration. The matter was adjusted without formal proceedings.

PENNSYLVANIA.

The Pennsylvania Central Light and Power Company. The Commission found that the company's rates for service in the borough of Lewistown are just and reasonable, and the complaint filed by J. Price Werts against the company was dismissed. The Commission held that the fact that the rates were higher in Lewistown than in other communities served by the company is without weight when the rates in question are reasonable.

WISCONSIN.

The Prairie duc Sac Mill and Light Company. The Commission determined the value of the electric property of the Prairie du Sac Mill and Light Company for the purpose of fixing the just compensation to be paid for the taking over the property by the village. The village contended that the value of the physical property, as shown by the Commission's inventory, was somewhat excessive. The Commission points out that the estimate of the engineer of the village was based upon "the theory of disposing of the plant piecemeal, and not upon the theory of the plant being in its entirety an operating unit rendering service." The Commission says: "Of course, no valuation based upon any other theory than that of the plant being a going concern can be accepted under the rulings of the court."

The Door County Telephone Company has been ordered to install full metallic service, and to comply with the standards for telephone service recently prescribed by the Commission. The service investigation was made subsequent to an order protecting the company in a monopoly of the field. The Commission held that the present company should be made to furnish adequate service, and refused to grant a certificate to a competing company.

The Wisconsin Telephone Company and the Rock County Telephone Company were ordered, in a previous decision, to make physical connection, and have been unable to agree in the matter of charges which each company is entitled to make for the use of its lines by the subscribers of the other company. The Commission has issued an order covering the matter of charges. In discussing the basis for determining the proper compensation, the Commission says: "We cannot assent to the doctrine asserted, that cost of service is the only consideration in fixing charges. The statute declaratory of the common law requires that charges shall be reasonable and just. It would seem that a charge which would result in taking business from one company and giving it to the competitor could not be regarded as a just charge from any viewpoint. Cost of service is never the sole consideration in determining the reasonableness of a charge. It is one of the primary considerations, but there are other considerations often as vital in reaching a conclusion."

Illinois Northern Utilities Company was ordered to extend the period of lighting service, and to comply with the standards of electric service in supplying the towns of Walworth and Fontana.

Boston Edison Safety Work Praised.

At a meeting of the New England Street Railway Club in Boston, Mass., on November 19, Dr. W. H. Tolman, director of the American Museum of Safety, New York, in discussing industrial safety propaganda, paid a tribute to the work of the Edison Electric Illuminating Company of Boston in this field. Lantern slides were shown of a portable lighting reflector trough used in the company's service buildings' garage to facilitate work under cars and to safeguard workmen, and of a reflecting mirror placed at a sharp curve on one of the yard driveways so that chauffeurs can see the approach to the curve in each direction. The Welfare Bureau of the Boston Edison Company, under the direction of Herbert W. Moses, has made a special study of accidents within the past two years and has made effective use of the accident prevention committee plan, besides giving the employees lectures on safety work, hygiene, etc., and contributing articles of a practical nature to the company publication, "Edison Life." Caution slips included in pay envelopes are a feature which has been helpful.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 13.

The magnetization curve at 1200 revolutions per minute of a 230-volt, 30-kilowatt shunt generator is shown in Fig. 14. The shunt field has 1000 turns. The resistance of the armature between brushes is 0.08 ohm and at full load the demagnetizing magnetomotive force of the armature is 600 ampere-turns.

Find (*a*) the resistance of the shunt field circuit which gives a terminal voltage of 230 volts at no load; (*b*) the critical resistance of the shunt field circuit; (*c*) the resistance of the shunt field circuit which gives a terminal voltage of 230 volts at full load; and (*d*) the terminal voltage at no load and at 1000 revolutions per minute with the shunt field resistance obtained in Question (*a*).

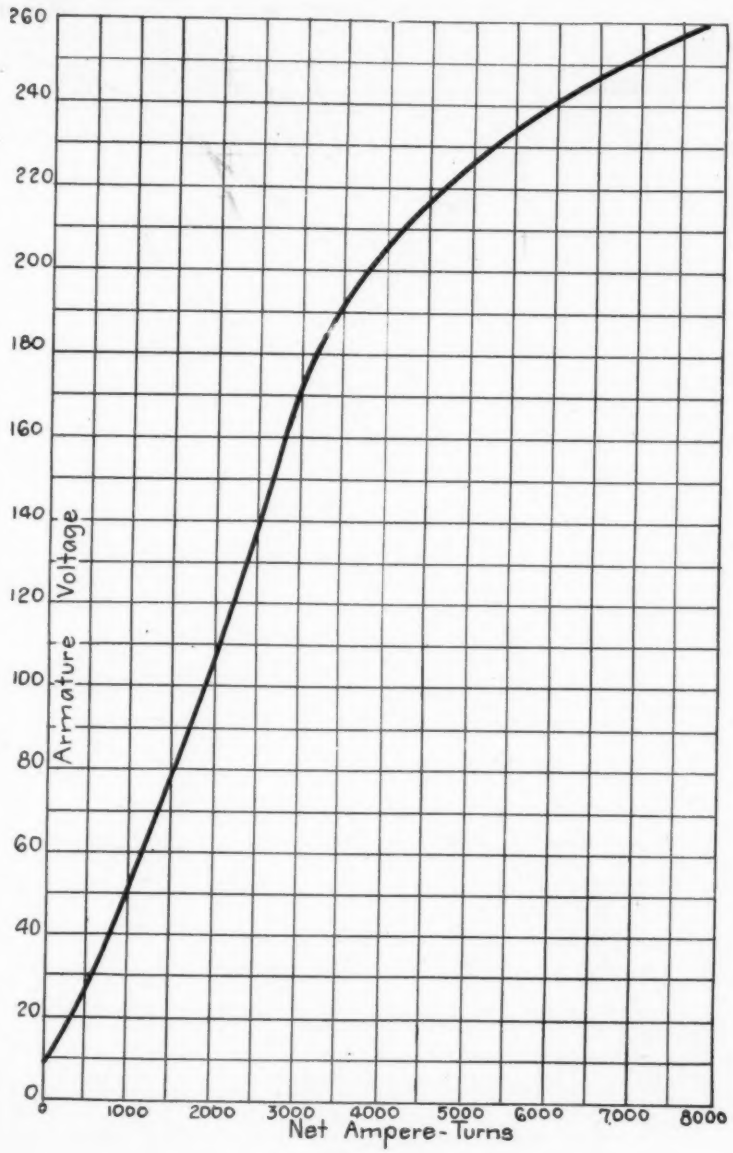


Fig. 14.

ALTERNATING CURRENTS.

Problem 63.

A laminated magnetic core has a mean length of 41.2 inches and a gross cross-section 3.50 by 3.46 inches. Twelve per cent of the gross cross-section is occupied by insulating varnish. It is desired to wind this core with a coil of copper wire which may be safely connected across a 230-volt, 60-cycle circuit. The number of turns in this winding is to be such that the core loss will be 150 watts at the stated voltage. The size of the wire is to be such that the resistance of the winding will be 0.21 ohm. Use the magnetic data given in problem 61.

(*a*) What current and power would this coil take if connected across a large 10-volt storage battery? (*b*) What current and power would this coil take if connected across a 230-volt, 60-cycle circuit? (*c*) If an air gap 0.24 inch long is cut in the magnetic core, what current and power will the coil take when connected across a 220-volt, 60-cycle circuit?

SOLUTION OF PROBLEM 13.

Answer to Question a.

The current (I_f) flowing in the sunt field winding of a shunt generator at no load is given by [6] or $I_f = E_a/R$ where (E_a) represents the armature voltage and (R) represents the sum of the armature resistance, resistance of the field winding and field rheostat. Conversely the resistance (R) is given by $R = E_a/I_f$. Since the field current corresponding to any number of ampere-turns (IN) is given by $IN/1{,}000$, a new scale of abscissas may be determined as shown in Fig. 15.

Then any line such as OA drawn through the origin will have a slope equal to E_a/I_f and since E_a/I_f equals (R) the armature voltage corresponding to any value of field and armature resistance is found by drawing a line such as OA (Fig. 15) of proper slope and noting the point of intersection with the magnetization curve. Conversely the slope of

a line, which cuts the magnetization curve at a definite armature voltage, gives the proper value of armature and field resistance to produce that voltage. Hence, drawing OA so that it cuts the magnetization curve at 230, the proper field and armature resistance equals the slope of this line or 230/5.25=43.8 ohms. Since the armature resistance is negligible compared with the field resistance and since the terminal voltage equals the armature voltage very nearly at no load the above value (43.8 ohms) represents very closely the proper field resistance to produce a terminal voltage of 230 volts.

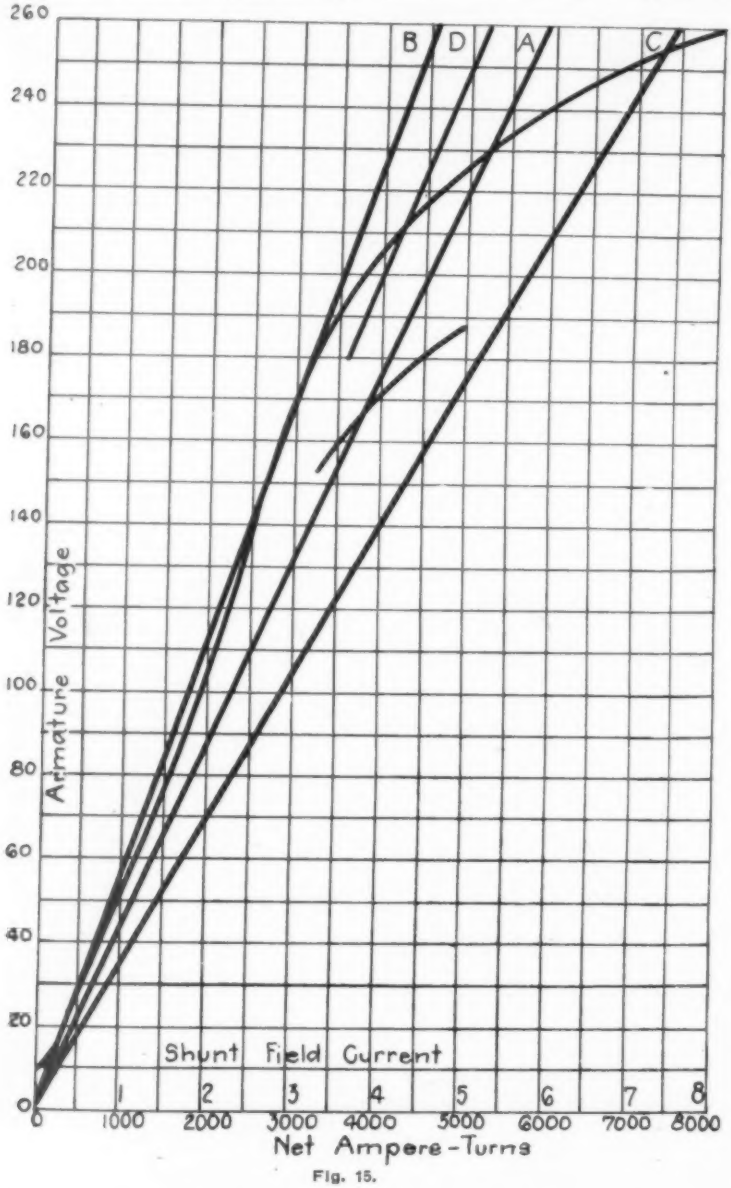


Fig. 15.

Answer to Question b.

If a line be drawn through O of such slope that it does not intersect the magnetization curve at any point it indicates that under such conditions of shunt field resistance and speed the machine will not build up. The slope of a line drawn tangent to the magnetization curve indicates then the critical resistance at which the machine will build up.

Drawing such a line (OB in Fig. 15) the slope is determined by taking any point on this line, such as 200, and dividing that value by the corresponding field current, 3.5 amperes. The slope is then 200/3.5, or 57.2 ohms. With this shunt field resistance the machine will build up to 168 volts but a very slight increase of field resistance or decrease in speed would cause the voltage to drop almost to zero. The operation of a shunt generator with the field resistance at the critical point is therefore unstable.

Answer to Question c.

At full load the line current (I_l) equals 30,000/230, or 130.3 amperes. At no load **(Question a)** the field current was 230/43.8, or 5.25 amperes. Assuming this value for the full-load conditions, the armature current (I_a) equals 130.3+5.25 or 136 amperes (approximately). Then the armature voltage (E_a) at full-load is given by [3]

$$E_a=230+136\times0.08=240.9 \text{ volts.}$$

The magnetomotive force (hereafter abbreviated mmf.) corresponding to 240.9 on the curve (Fig. 15) is 6,000 ampere-turns. The gross mmf. must then be 6,000+600, or 6,600 ampere-turns, since 600 ampere-turns must be added to neutralize the demagnetizing mmf. of the armature. Since there are 1,000 turns on the shunt field, the field current (I_f) must equal 6,600/1,000 or 6.6 amperes and the field resistance (R_f) equals 230/6.6 or 34.9 ohms. It should be noted that the armature current (I_a) actually equals 130.3+6.6 or 136.9 amperes and that the armature voltage (E_a) equals 230+.08× 136.9 or 240.9 volts as before, so that the original assumption of the field current for the purpose of calculating the armature voltage was sufficiently accurate.

If the load on the machine were removed by opening the line switch the terminal voltage would rise to the point of intersection of the magnetization curve and the line OC (Fig. 15) which has a slope of 34.9. The terminal voltage at no load is then found to be 254 volts. The voltage regulation ($V.R.$) of a generator is given by the ratio [30]

$$V.R.=(V_0-V_F)\ 100/V_F \text{ per cent}$$

where (V_0) is the terminal voltage at no load and (V_F) the terminal voltage at full load, the field resistance being the same in each case. Hence by [30]

$$V.R.=(254-230)\ 100/230=10.4 \text{ per cent.}$$

The voltage regulation ($V.R.$) then represents the percentage change in terminal voltage when the load is reduced from full load to no load.

Answer to Question d.

To determine the no-load terminal voltage at 1,000 revolutions per minute with a field resistance of 43.8 ohms a new magnetization curve may be plotted by reducing the ordinates of the (1,200 R. P. M.) curve in a ratio of 12 to 10. A short section of such a curve is plotted in Fig. 15 and the no-load terminal voltage may be determined by noting the point of intersection of the (1,000 R. P. M.) curve and the line OA which has a slope of 43.8. The no-load voltage is thus found to be 168 volts. The same result may be obtained more quickly by drawing a line through O with a slope equal to 1,200×43.8/1,000. Then note the point where this line cuts the (1,200 R. P. M.) curve (202 volts in Fig. 15. Line is not shown). The no-load terminal voltage at 1,000 revolutions per minute will then equal 1,000×202/1,200, or 168 volts.

Note. The reader may expect to obtain slightly different results than those

given above since one cannot determine the intersecting points on the curves with a high degree of accuracy unless the magnetization curves are drawn to a large scale.

SOLUTION OF PROBLEM 63.

Answer to Question a.

If the magnetic flux which *links* an electric circuit varies there will be an electromotive force produced in the circuit. No amount of *constant* flux will produce the least voltage in the circuit. When a direct voltage, such as a storage battery gives, is impressed on a coil that is wound on a magnetic core it may require several seconds for the current to reach its final value. During the time that the current is increasing the flux which links the coil is also increasing and an electromotive force is produced in the winding which opposes the flow of the current. In a few seconds the current practically becomes steady and the flux ceases to increase so that there is no electromotive force to oppose the flow of the current, which is then equal to the impressed voltage divided by the resistance of the winding.

$$I = 10/0.21$$
$$= 47.6 \text{ amperes.}$$
$$P = 10 \times 47.6$$
$$= 476 \text{ watts.}$$

Answer to Question b.

When an alternating voltage is impressed on a circuit of this sort the current and the flux which links the winding vary very rapidly. The rapid variation of the flux produces an alternating electromotive force in the coil which is usually about equal to the voltage impressed on the circuit. The vector difference between these two voltages is the resistance drop in the winding and this is usually very small. If this is the case the problem is simple, otherwise it becomes quite difficult. Luckily in many cases the resistance is so small that the voltage generated by the flux is practically equal to that impressed on the circuit. In this case we have:

[37a] $230 = 4.44\,N \times 60 \times \phi_m \times 10^{-8}$

The turns, N, are such that the core loss is 150 watts.

Core loss per cubic inch $= 150/V$

$V = (1.00 - 0.12)\ 3.5 \times 3.42 \times 41.2$

$= 434$ cubic inches.

Core loss per cubic inch $= 0.346$.

From the table in Problem 61 the maximum flux density for this core loss is 72.84 kilolines per square inch, and the magnetizing force is 6.77. The total flux will be:

[38a] $\phi_m = (1 - 0.12) \times 3.50 \times 3.42 \times 72{,}840$

$= 767{,}000$ lines.

The number of turns, N, is:

$N = 230 \times 10^8 \div (4.44 \times 60 \times 767{,}000)$

$= 112$ turns.

The magnetizing force is $0.7\ NI_\phi/l$ and therefore

$$0.7\ NI_\phi l = 6.77$$
$$I_\phi = 6.77 \times 41.2/0.7 \times 112$$
$$= 3.56 \text{ amperes.}$$

The core-loss component of the current is the core loss divided by the impressed voltage and is:

$$I_c = 150/230$$
$$= 0.652 \text{ ampere.}$$

The total current in the coil is the square root of the sum of the squares of these two components.

$$I = \sqrt{I_\phi^2 + I_c^2}$$
$$= 3.62 \text{ amperes.}$$

The resistance drop in this case is 3.62×0.21, which equals 0.76 volt. This resistance drop is very nearly in quadrature with the impressed voltage so that it produces practically no effect in reducing the voltage generated by the flux.

The copper loss is, by [4a]

$$\text{Loss} = 3.62^2 \times 0.21$$
$$= 2.8 \text{ watts.}$$

The total power supplied to the coil is the sum of the core loss and the copper loss and is 152.8 watts.

Answer to Question c.

As before, we will assume that the resistance drop has practically no effect in reducing the voltage generated by the flux. It will therefore be 230 volts, and the flux as given by equation [37a] will be 767,000 lines. The flux density is al-

DIRECT CURRENTS.

Problem 14.

Given the magnetization curve (See Fig. 13, Problem 13) of a series generator at 1,200 revolutions per minute. The continuous current-carrying capacity of the armature is 137 amperes; resistance of series field, 0.05 ohm; demagnetizing mmf. of armature at 137 amperes load, 600 ampere-turns; resistance of armature between brushes, 0.08 ohm; number of turns on series field, 30. Note that magnetization curve is obtained by *separately exciting* the machine.

Find (*a*) terminal voltage when armature current is 137 amperes; (*b*) the resistance which must be connected in parallel with the series winding to give a terminal voltage of 100 volts when the line current is 137 amperes, and (*c*) the percentage decrease of the machine capacity when the speed is reduced to 1,000 revolutions per minute, the series field being unshunted as in Question *a*.

This problem illustrates the effect of series-field shunt resistance, armature reaction and speed upon the operation of a series generator.

ALTERNATING CURRENTS.

Problem 64.

A 50-kilovolt-ampere, 22,000-440-volt, 60-cycle transformer has the following constants:

High-tension winding: Resistance, 64.4 ohms; leakage reactance, 229 ohms. Low-tension winding: Resistance, 0.0257 ohm; leakage reactance, 0.092 ohm.

(*a*) What are the equivalent resistance and the equivalent reactance on the high-tension side? (*b*) What are the equivalent resistance and the equivalent reactance on the low-tension side? (*c*) If the low-tension winding is short-circuited, what voltage should be impressed on the high-tension winding in order that there will be full-load current in both windings? What power will be supplied? (*d*) If the high-tension winding is short-circuited, what voltage should be impressed on the low-tension winding in order that there will be full-load current in both windings? What power will be supplied? (*e*) If a reactor which has a resistance of 0.05 ohm and a reactance of 0.10 ohm is connected in series with the low-tension winding, what will be the equivalent resistance and reactance of the high-tension side of the transformer and added reactor?

This problem illustrates the calculation of the equivalent constants of a transformer.

Solutions of the above problems and two new problems will be printed in the next issue.

so the same as before so that the magnetizing force necessary to establish this flux in the iron is unchanged.

The number of ampere-turns required to produce this flux in a core 41.2 inches long is the product of the turns in the winding and the magnetizing component of the current and is

$$112 \times 3.56 = 399.$$

On account of the air gap that is cut from the core its length is 40.96 inches and the number of ampere-turns required for the iron is now

$$40.96 \times 399 \div 41.2 = 397$$

The number of ampere-turns necessary to produce in air a flux with a density, B, between two parallel surfaces which are separated by a small distance compared with their dimensions is

$$NI = 0.314\, lB$$

In this expression l is the length of the air gap in inches and B is the flux density in lines per square inch. In this problem:

$$NI = 0.314 \times 0.24 \times 72{,}840 = 5490.$$

Notice how much greater is the number of ampere-turns necessary to produce a given flux in a small air-gap than in a considerable length of iron core.

The total number of ampere-turns is

$$NI = 397 + 5{,}490 = 5{,}887.$$

The necessary magnetizing component of the current is

$$I_\phi = 5{,}887 \div 112 = 52.5 \text{ amperes.}$$

Since the flux density in the iron is not changed the core loss will be only slightly reduced on account of the smaller volume.

$$P_e = 40.96 \times 150 \div 41.2 = 149 \text{ watts.}$$

The core-loss component of the total current is

$$I_e = 149/230 = 0.648 \text{ ampere.}$$

The total current is the square root of the sum of the squares of its two components.

$$I = \sqrt{52.5^2 + 0.648^2} = 52.5$$

In this case the core-loss component is so small as to be negligible.

The resistance drop is now 11 volts but it is so nearly in quadrature with the terminal voltage that it still has practically no effect in reducing the voltage generated by the flux. The latter is actually about 229.7 volts.

The copper loss is, by

[4a] $$P = 52.5^2 \times 0.21 = 580 \text{ watts.}$$

The total power supplied to the coil is the sum of the core loss and the copper loss and is 729 watts.

It is interesting to compare the power-factors in the two cases, by [2a]

$$P.F.\ (b) = 152.8/(230 \times 3.62) = 0.189$$

$$P.F.\ (c) = 729/(230 \times 3.62) = 0.0604$$

Report on Water-Power Development of Sanitary District of Chicago.

An extended report on the hydroelectric development of the Sanitary District of Chicago has been made by the District's Commission on Sewage Disposal and Water-Power Development, composed of Lyman E. Cooley, John Ericson, Wm. Artingstall and L. K. Sherman. This report is a critical study of one of the most important publicly owned and operated American electrical utilities.

The report first briefly reviews the history and legislation leading up to the construction of the main Drainage Canal between Chicago and Lockport, Ill., and the subsequent extension thereof to near Joliet, Ill., in order to utilize on a sufficiently large scale the potential power created by the canal flow through the declivity between Lockport and Joliet. The construction of the main canal, its extension, the power house and auxiliary works are described.

A careful analysis is made of the law passed in 1903 authorizing the water-power development, which constituted a semi-independent utility, under the authority of the Sanitary District but collateral to its main functions. Separate accounting was to be made for all expenditures and revenues of the water-power development. The investment is represented by a special tax and by an interest-bearing loan from the District's general fund, the latter to be repaid from surplus earnings and such further earnings to reduce direct taxation.

The District's accounts show that the water-power enterprise has not been charged with all the investment due to an independent utility. Insufficient allowance was made for preliminary and early overhead expenses. Part of the advances from the general fund were repaid without interest from the proceeds of the special tax. Under the contract with the city of Chicago for rehabilitation of its street-lighting system, no allowance was made for overhead expense. In 1908 there was written off about $1,400,000 from the water-power account and charged to other accounts of the District without legal warrant.

Data are given in the report of the total water-power expenditures authorized by the act of 1903 year by year from 1903 to 1913, inclusive; also of the earnings in 1908, when operation began, to 1913, inclusive. At the end of 1913 the total construction expenditures, including engineering, were $6,714,201.06; administration costs, $964,189.88; interest at four per cent on loans from the general fund, $2,073,001.48; operation, maintenance and unassigned expenditures, $1,534,435.24. The cash earnings to the close of 1913 were $3,196,117.07. Deducting these from the total of all the expenditures mentioned leaves $8,089,710.59 as the total outstanding investment on December 31, 1913. Advances have also been made to Chicago and other municipalities for improvements in street-lighting systems, which are added in the report to the foregoing investment, thus making the grand total really $10,980,568.28 at the end of 1913. Of this, $3,056,625.55 was supplied by the special water-power tax, the remainder being loaned from the general fund.

The rules of the electrical department include provisions for sinking fund and depreciation, but the former has been ignored in actual practice, because the net earnings, after meeting operation and maintenance costs, are automatically applied to canceling indebtedness. Depreciation is ordinarily covered by current repairs and renewals and charged to maintenance.

Analysis of the income of the electrical department shows that the commercial customers in 1913 received 26 per cent of the energy sold and paid 55 per cent of the earnings. The city of Chicago received for street lighting and other bulk service 53 per cent of the total output sold and paid 27.5 per cent of the earnings. Including revenue for operating the city's substations, this Chicago load brings 0.59 cent per kilowatt-hour, a figure found to be unremunerative and below cost. Discrepancies in rates exist, at least in the older contracts. The rates to municipalities are not equitable and have been a matter of dicker between public agents who try to utilize the taxing powers of other governmental agencies whenever possible. The present income of the water-power development is barely adequate to meet the current expenses for fixed charges and overhead, and leaves no surplus for betterments or the redemption of loans. Unless the minimum rates are increased, the District must continue to invest new capital.

The Commission recommends that more day load be taken on to make practically constant load throughout the 24-hour day; the load-factor now varies from 56 per cent in June to 71 per cent in December; in the latter month in 1913 the maximum load was 21,600 kilowatts. The commercial lighting load should be discarded as it merely creates a peak load; the overlap of the day and night loads should also be avoided. Ample generators are provided at the power house, but the capacity is restricted by the limited water flow and by inequalities of level in the lower channel (which may be avoided by its enlargement so as to increase the available head). By improving the efficiency through modernizing the power-house installation and by completing work now under way on the main channel and its feeding adjuncts the capacity will be increased. The administrative system of the electrical department should be re-

vised and simplified. The Commission also recommends that, as soon as conditions permit, the distribution or retailing of the electrical energy be relegated to the municipal corporations served, or otherwise that it be disposed of to other corporations or persons at the market rate.

The report is supplemented by some 100 printed pages of digests of the data available for preparing the report. These are in five parts: historical and descriptive, expenditures, results of operation, service contracts and earning rates, operating conditions.

At a meeting of the Board of Trustees of the Sanitary District held on November 30, the report of the Commission was accepted. George M. Wisner, chief engineer of the District, was directed to report on the hydroelectric system as a going concern and on the efficiency of the Lockport plant. Prof. Gardner Williams was delegated some time ago to report a rational system of rates and means for selling the energy generated to the best advantage.

Electrical Developments.

Sir John Snell, the new president of the Institution of Electrical Engineers, covered a variety of matters in his inaugural address delivered in London on October 29. The position of the Institution in relation to the industry was touched upon and a new committee to consider such matters was suggested. Questions such as the remuneration of the young engineer and the desirability of those in authority as chief engineers doing what they could to remedy the grievance of the younger members of the staff; legislation; bulk supply; domestic supply; future charges to consumers; and the trend of electrical improvements, were discussed. Sir John prefaced his comments on these matters by referring to the part that was being played by members of the Institution in the national services during the present period of war.

Development was increasing almost in a goemetrical progression, and electrical engineering covered a vast field ranging from the useful application of great natural sources of power, as typified in the utilization of the waters of Niagara or other great waterfalls, to the development of wireless telegraphy and its immeasurable effect on the preservation of human life and property. Looking back at the early applications of dynamic electricity, one could not fail to be impressed by the vast developments that had taken place in the 35 years which had passed since that time.

"Electrical machinery of enormous power is now common with efficiencies of only 1 or 2 per cent short of the ideal; the great development and flexibility of three-phase machinery, the employment of very high voltages over great distances, the transmission of power of hundreds of megawatts, oceanic wireless telegraphy, wireless telephony, and the applications of electricity in surgery, represent only some of the world-wide applications of electricity which are leaving an ineffaceable mark on human progress and are helping to conserve the available energy in the world.

"We electrical engineers have not the opportunities, it is true, of leaving great memorials behind us so monumental as a Sphinx, a Colosseum, a Forth Bridge, an Assouan Dam, or a Panama Canal. While, however, the results of our work are not so monumental in one respect, I venture to say that the cumulative effect of the better utilization of fuel and the avoidance of waste, the harnessing of natural sources of power which would otherwise be wasted, the diminution of smoke, the better facilities of transit, and the effect on housing problems and public health, the swift communication of news and its effect on political relationships, and the greater fraternization of peoples, the beneficent effects of telegraphy and its assistance to those in distress at sea—all these have, and will have, an effect on man and his progress which in itself will be monumental."

In discussing the trend of improvements, Sir John Snell said that definite and accepted standards were gradually being arrived at. In power-station work there could be no question that three-phase generation had such great advantages over any other system that it must be generally accepted as the system of the future. Turbo-alternators of the highest adaptable speed coupled to machines of simple design (by simple machines he meant one bar per slot) having the lowest consequential terminal pressure—stepping up through static transformers (thus giving the necessary protective reactance) to the switchboard busbar pressure—were almost certain to be generally adopted. Higher feeder pressures, now that insulated cables for very high pressures were commercially practicable, would no doubt be used, and distribution by the three-phase four-wire system will be, in his opinion, adopted wherever possible.

This did not mean that batteries would not also play an important part in electrical distribution systems. They could, of course, be readily provided for in substations through the medium of rotary transformers. Simplicity was, however, what must be aimed at, the invariable result of which was economy.

Steady progress towards standardization was being made in the manufacturing section. If apparatus of whatever kind could be turned out in quantities, the articles were cheaper than when the stock order was small. "Whether it be units of energy or motors, the curve of cost per unit or per motor will be hyperbolic. There are fixed charges and running charges in both, and the greater the quantity, within given limits in each case, the smaller the cost of each. Is this always realized?"

Sir John said that electrical science had rendered a great service to many other industries besides engineering—in teaching exactitude of measurements and in making more widely known the underlying principles of the cost of production. Continental electrical manufacturers had realized that and if British works would turn out standard plant more boldly and in numbers, economies to suppliers and purchasers alike would result and increased output.

Steady progress was being made in British designs by the better utilization of raw materials. There was now very little superfluous iron, steel, or copper in generators and motors. In distribution systems perhaps the same progress had not been made. For instance, an appreciable waste took place in most cities through the constant taking up and relaying of pavements by the gas, water, telephone and electrical authorities, all of which work had to be paid for. Some co-ordination here was distinctly advisable. Sir John referred more particularly to a more systematic design of extensions of the distribution systems themselves. It was true that a few chosen standard sizes of cables were now generally adopted in any given net work; still it seemed to him that unnecessary copper and lead were often laid down in a hurry, when a skilled consideration of plans prepared well in advance would generally result in economies, while affording at the same time a better pressure distribution and greater facilities for sectionalizing the system in emergencies.

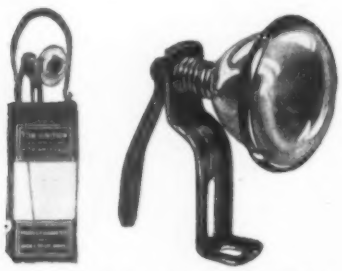
Kasson, Minn., Has White Way Celebration.

The completion of a new "white way" lighting system at Kasson, Minn., has just been celebrated with a "blaze of glory." A general invitation was issued by the commercial club to the surrounding towns and country, bidding the people to come and behold the light, to participate in an entertainment and a feast, and to leave their pocketbooks at home. Free moving picture shows and a free supper were inducements offered to guests. When all was ready and suspense at the proper tension, Miss Frances Brown, daughter of the mayor, pressed the button in the new lighting plant, and straightway church bells, fire alarms, automobile horns and whistles vied with one another in the turbulent medley of entertainment. The lighting system consists of eight five-light posts to the block, except on side streets where the three-light type posts are used.

New Electrical and Mechanical Appliances

A New Electric Hand Lamp.

The great popularity of the electric flashlight as a means of eliminating the very dangerous use of matches, candles and oil lamps when looking for anything in dark closets, etc., is continually bringing forth new types of these devices. One of the simplest and most convenient of these is the so-called "Wonderlite," which is shown in the illustrations herewith. It is of very simple construction, and can be readily attached to any standard form of dry cell, such as is used for bells, buzzers, ignition purposes, etc. It is screwed directly to the top of such cell, whether the same be round or square, connection being made directly to the terminals. The outfit has a very powerful reflector and a high-efficiency lamp. A spring contact acts as the switch. The manufacturer states that in connection with any standard dry cell this



"Wonderlite" Complete and Detached.

outfit will give 20 hours of continuous use, and from 40 to 50 hours of intermittent use. The entire outfit is not only simple and well made but relatively inexpensive in cost. The cost of battery renewal is low, and the efficiency attained is higher than when special forms of dry cells are used.

Frederick Rall, 19 Park Place, New York City, is general sales agent for the manufacturer.

An Indicating Key Socket.

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has placed on the market a key socket arranged for indicating whether the circuit is open or closed. The key is so designed as to have a pointer on the end; when this pointer turns toward the lamp or other consuming device it indicates that the current is on; when it is turned away from the lamp or device, it indicates that the current is off. For this purpose the switch mechanism is arranged to require that the pointer be turned through 180 degrees instead of 90 degrees, as is the usual custom. The mechanism is of very substantial con-

Indicating Key Socket.

struction and of the quick-make-and-break type. The socket is rated at 660 watts, 250 volts.

Other features in this new socket that are of novel design are the method of holding the screw shell, the bayonet lock of cap and shell, and the locatable cap. The screw shell of the socket, instead of being held by screws is clamped into the porcelain. This prevents loosening of the shell, due to twisting of the lamp or attachment plug. The cap and shell are joined by an automatic bayonet lock, which holds them securely together, and is very quickly opened or closed. The cap has a separate nipple of collapsible construction. This has been designed to facilitate the use of the socket in fix-

Special Nipple in Cap.

tures with socket-covering husks. The upper part of the nipple is undercut so that when the cap is screwed into a husk, with a special tool furnished without charge by the manufacturer, this undercut portion on reaching a certain point on the threaded nipple of the fixture gradually collapses. This allows the socket key to be located at any point in alinement with the keyhole in the husk; this construction also tends to grip the cap firmly on the fixture without using the set-screw that is always very difficult or entirely impossible to reach inside of the husk Formerly in husk work sockets frequently loosened, but the binding due to the clamping nipple prevents this in the new type of socket illustrated. In addition to the above features the socket can be located by means of the two protruding, riveted studs in the bayonet lock. This positive lock can be readily seen inside of the husk, and it is not necessary to listen for the click as where the lock is concealed.

New Metal-Sign Receptacle.

A new Paiste sign receptacle has been designed to meet the requirements of a large sign-manufacturing company. The shoulders for the holding screws have been made very much heavier to withstand all the wrenching which they may receive. The special feature of this receptacle, outside of its strength, is in the provision of the

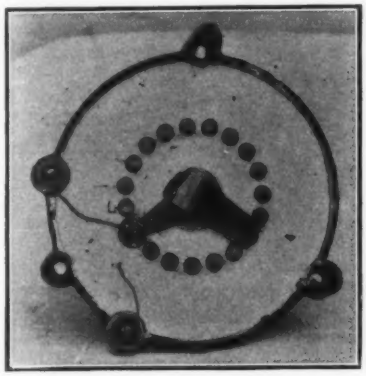
Sign Receptacle.

wide slots and the guides that lead the holding screws down to the nuts. This makes it very easy to put the holding screws in and saves a great deal of time for the workman. The nuts for the holding screws are fastened in place by clips so that they cannot get out of position. The center contact is of phosphor bronze as in all Paiste sockets and receptacles. This new receptacle is sold by the Hart & Hegeman Manufacturing Company, Hartford, Conn., general sales agent for all Paiste products.

New Types of Ward Leonard Resistors.

Formerly it has been impossible to secure any standard enameled type of field rheostat smaller in diameter than 8 inches. While this size is ample for medium-sized dynamos and motors, it has not met the requirements for the smaller machines. The Ward Leonard Electric Company, Bronxville, N. Y.,

has recently placed on the market an enameled rheostat only 6 inches in diameter, suitable for small machines. This rheostat is of the standard enameled type that has been manufactured by the company for the last 20 years. It has 18 steps. The rheostat can be used for either mounting on the front or the back of a switchboard or panel, and can be quickly changed from one type to the other. A new type of inexpensive handwheel for use with the



Six-Inch Field Rheostat.

back-of-board mounting is a feature of this small rheostat.

The company has also developed a very compact form of high-resistance unit. This has a resistance of 15,000 ohms, and yet is only 4 inches long

Compact Resistance Unit.

and seven-sixteenths of an inch in diameter. Its rated capacity is 40 watts. The resistance wire used has a temperature-coefficient of practically zero. The wire is wound in one layer and thoroughly protected by enamel from all oxidization or other deterioration. This avoids the depreciation usually met where fine wires are exposed to the air or are imbedded in cement, Japan, shellac or other insulating material aside from enamel.

A New Line of Cutler-Hammer Magnetic Switches.

A new line of magnetic switches has recently been developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This includes a new magnetic lockout switch of the series-coil-operated type and a redesigned line of shunt-coil-operated switches. Both are of the clapper type construction. The new magnetic lockout switch is for automatic motor-starting purposes and has a number of features claimed to be of particular advantage and importance. Earlier types of series-wound switches, because of having in their magnetic circuits a section of restricted area, had comparatively small sealing pull and contact pressures. As this new magnetic lockout switch, see Fig. 1, has no such restricted area in its magnetic circuit, the sealing pull is equal to that of the shunt-coil-operated switches of the same capacity, thus permitting higher contact pressures and greater "follow-up" on contacts to allow for wear. Tests made to determine the relative contact pressures of these magnetic lockout switches and the single-coil series switches of the restricted area type showed that that of the former was 60 per cent greater than that of the latter.

The Cutler-Hammer magnetic lockout switch has the characteristic of remaining open when the current passing through its windings exceeds a predetermined and adjustable value, and when the current falls below this value the switches close. The same contacts, the same "follow-up" and the same auxiliary contacts are used as are employed on shunt-coil-operated magnetic switches of the same capacity, a feature heretofore not to be found in other lines of switches. On the 100-ampere switches, the arcing contacts are also the current-carrying contacts. For the larger size switches laminated-brush contacts carry the current, and auxiliary arcing contacts are provided.

The series-wound operating coil of the magnetic lockout switch is divided into two parts, the upper being bar wound and the lower consisting of copper and asbestos ribbon. The upper section of the coil tends to close the switch and the other to hold it open. This switch is made up as a single unit, and numbers can be assembled according to the number of steps of resistance used in the motor circuit in starting. Fig. 2 shows four of these accelerating switches on a 75-horsepower, 230-volt motor panel.

Cutler-Hammer direct-current magnetic switches that have been furnished for the past several years have been of the clapper type in the smaller sizes, while the larger sizes have been of the contactor type. At the time of bringing out these new magnetic lock-

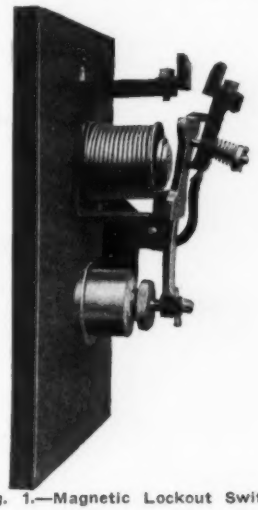


Fig. 1.—Magnetic Lockout Switch.

out switches, the shunt switches were redesigned so as to make them all of the clapper type. The advantage of the clapper type switch lies in its greater arc-rupturing capacity, longer

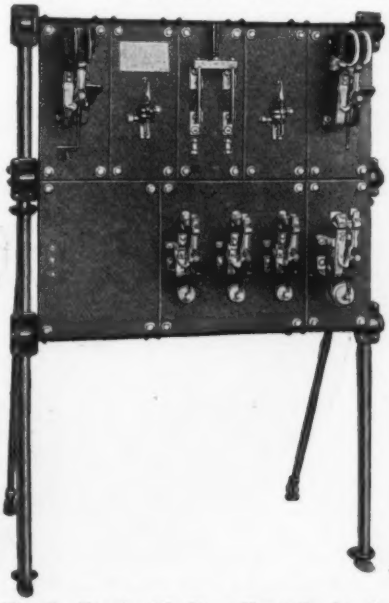


Fig. 2.—Panel with Four Magnetic Accelerating Switches at Bottom.

life of the contacts, more rapid operation, easier access to parts subject to inspection and repair, and the possibility of interchanging parts with the magnetic lockout type switches. The new line of magnetic switches is made in 11 sizes and types ranging in capacity from 50 to 3,600 amperes.

A New Electrical Long-Distance Transmitting, Indicating and Recording System.

A new electrical long-distance transmitting, indicating and recording system is being placed on the market by the Bristol Company, Waterbury, Conn. In these instruments Bard's patent long-distance induction-balance movements are employed as especially developed for this purpose by the Sangamo Electric Company, Springfield, Ill. Bristol recording instruments when equipped with these electrical transmitting systems are capable of producing automatic and continuous records of pressure, liquid levels, temperatures, mechanical motions, etc., at long distances from points at which the transmitters are located.

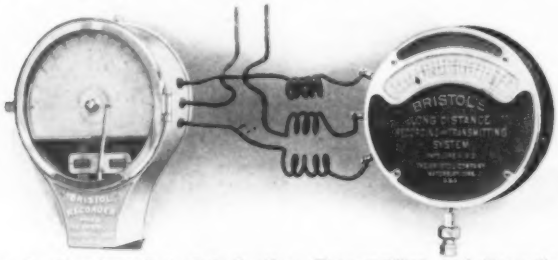


Fig. 1.—Standard Set of Indicating, Transmitting and Recording Instruments.

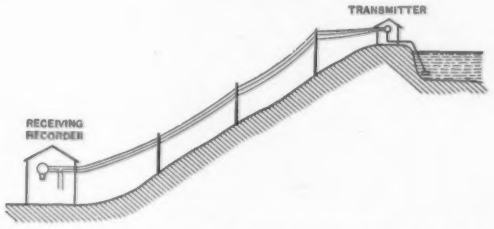


Fig. 2.—Arrangement of Typical Installation of Long-Distance Indicator and Recorder.

Fig. 1 shows a standard unit of these transmitting recording instruments, including the transmitting indicator for installation at the point where the pressure or temperature, etc., is measured, and the receiving recorder which is installed at the remote point where it is desired to have the record produced. The two instruments are shown connected by three wires, one of which is connected to a source of alternating current, such as, for instance, a lighting circuit.

This long-distance system is particularly well adapted for use under ordinary operating conditions because of its simplicity of construction. There are no sliding or make-and-break contacts employed, and the effects of variation of temperature or resistance along the circuit are negligible. The recording instrument may be installed many miles distant from the measuring and transmitting device. For instance, if 110 volts and No. 14 copper wires are used, the recorder may be located 30 miles from the transmitter, or if No. 12 leads are used the recorder can be installed 40 miles or more from the transmitter. The transmitting device is mounted in a moistureproof case, and can be installed outdoors if necessary, as for instance, on the bank of a reservoir.

The needs for such equipment are numerous in connection with waterworks, central heating stations, hydroelectric plants, gas distribution systems and irrigation projects.

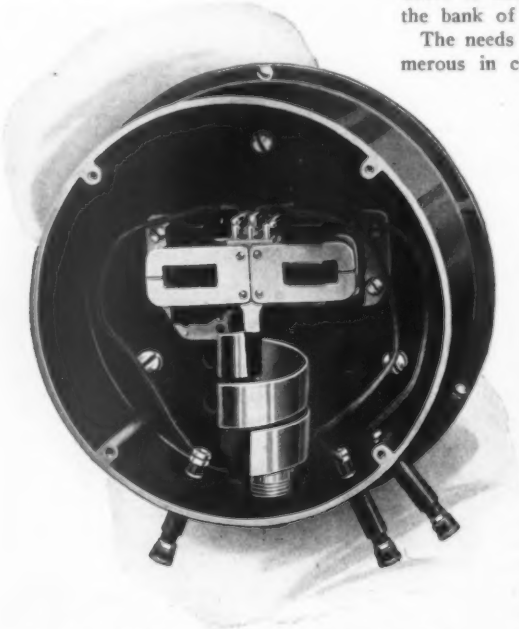


Fig. 3.—Interior of Transmitting Instrument.

Fig. 2 shows a typical installation of one of these long-distance transmitting and recording systems with the transmitting indicator installed on the bank of reservoir, and the recording instrument installed at a distance in the pumping station, so as to avoid the necessity for inefficient and expensive messenger service between the reservoir and the point at which the pumping apparatus is installed.

Although this equipment is only now being put on the market in commercial form, it is not untried, as preliminary models have been in actual service giving satisfactory results for more than four years.

One of the first sets of these patented instruments was installed at Peoria, Ill., to indicate at the central station the steam pressure at the end of the steam heating main, and the superintendent of the electrical department of the Central Illinois Lighting Company, by whom this was used, has made the following statement: "In regard to this particular outfit, which has been in service more than four years, two other systems were installed by us on the strength of the success of the first system, and all have given very good service." Several other sets of this equipment have also been in successful service for more than two years.

The fundamental principle of the Bristol long-distance transmitting and recording system is that of the induction balance. The transmitting and the receiving instruments are each equipped with two pairs of coils arranged to swing in a horizontal plane over iron cores. Fig. 3 shows the interior of one of the transmitting instruments. In this instrument the helical form of pressure tube and the electrical transmitting device are shown in the operating position. Figs. 4 and 5 are detailed front and top outline diagrams of the transmitting device, which is similar to the receiver.

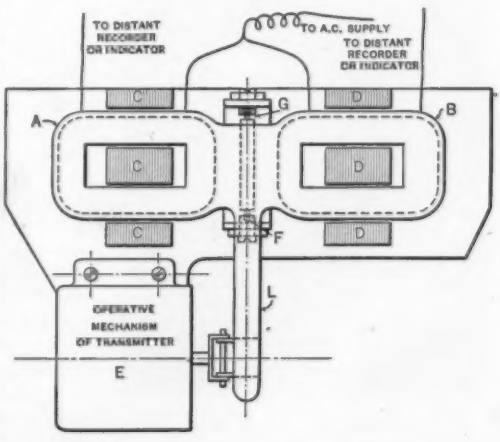


Fig. 4.—Diagram of Front of Transmitter.

The complete outfit consists of two pairs of mechanically balanced solenoids arranged to swing horizontally back and forth over the ends of soft-iron cores and connected in parallel to an alternating-current circuit. One pair of the solenoids is used for the transmitting instrument, the other pair for the receiving instrument. The front view (Fig. 4) of the transmitter shows one pair of the solenoids *A* and *B* on spools connected together and supported on a shaft, the ends of which rest in jewel bearings at *G* and *F*; these solenoids are free to swing back and forth over laminated soft-iron cores *C* and *D*. The top view (Fig. 5) shows the solenoids *A* and *B* of the transmitter in section and by the dotted outline the position to which the solenoids may swing is also indicated.

A similar pair of balanced solenoids is placed in the receiving recorder or indicator at the distant point. When the solenoids *A* and *B* of the transmitter and receiver are connected in parallel to an alternating-current circuit and the transmitter coils *A* and *B* are held in some certain position by the operating mechanism located at *E* (water-level gauge, pressure gauge, thermometer, etc.), the relative amounts of current flowing in solenoids *A* and *B* will depend on their positions on the iron cores *C* and *D* due to the inductive effect of same.

At the receiving instrument the other pair of solenoids are mechanically balanced and free to take an angular position which will be the same as that of the transmitter, since the flow of current will be the same in the corresponding solenoids of the receiver as in the transmitter. If the angular position of the pair of solenoids at the transmitter is changed by the operating mechanism, thus moving one of the solenoids off and the other on to the iron cores, therefore increasing the inductance in one solenoid and diminishing it in the other, the flow of current will be proportionately increased in one coil and diminished in the other. The variations of current at the distant receiver will correspond with the variations at the transmitter and cause the pair of solenoids of the receiver to seek a position of balance which will be the same as that of the solenoids of the transmitter.

In the transmitter the operating mechanism is linked directly to the balanced solenoids by means of an arm *L*. In the receiver the recording pen or the indicating pointer is connected to a similar arm through a simple, and practically frictionless multiplying mechanism.

Various combinations of transmitting and receiving instruments of either indicating or continuous recording type may be furnished. Fig. 1 illustrates the standard equipment, including a transmitting indicator and a receiving recorder, but it is possible to furnish the transmitter and receiver in either the indicating or recording type. Fig. 6 shows a combination outfit including two transmitters and one receiving indicator connected with a two-point rotary switch so that readings may be obtained with the indicator of the pressures, temperatures, etc., from either of the transmitting instruments.

A great variety of applications for this apparatus will arise owing to its flexibility and extreme simplicity.

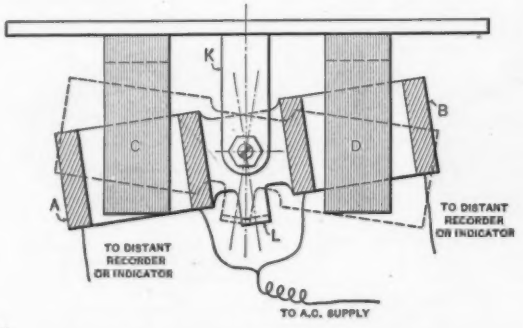


Fig. 5.—Diagram of Top of Transmitter.

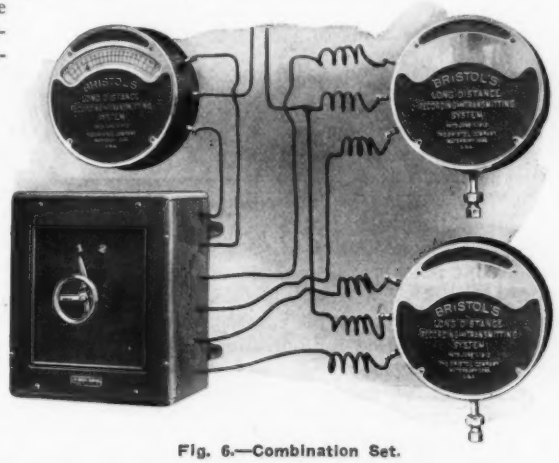


Fig. 6.—Combination Set.

Electric Operations Company.

The Electric Operations Company, which previously conducted business under the name of McLeer Electric and Manufacturing Company, has located its factory and offices at the Bush Terminal, 234 Thirty-sixth Street, Brooklyn, N. Y. The location of this plant is an ideal one, on account of the shipping facilities both by rail and water, while light, heat and power are supplied from a common source. Some of the products manufactured by the Electric Operations Company are the "Safety" incandescent arc fixtures, "Safety" steel service and cutout boxes, the "Safety-First" fire extinguishers, etc.

Electric power for operating the various machines of the plant is furnished from the central station. A 135-horsepower direct-current motor operates the different shafting by means of belt drive. The larger sized machine tools have their own separate motors, while the smaller machine tools are operated in groups. As the power furnished is alternating current the plant has installed a 65-kilowatt motor-generator set (belt driven) for testing alternating-current motors, and for operating electric welding machines, etc.

Much general machine work and repair work is also being done here, as well as armature winding for railway motors, and for regulating field and magnet coils a special department is provided. It is well equipped with the necessary facilities to turn out work effectively on short notice.

The Electric Operations Company employs between 80 and 100 men, according to demand.

Of the various types of "Safety" incandescent arc fixtures manufactured are those for outdoor illumination and large interiors. The fixtures consist of heavy copper casing with substantial cast-iron ventilating canopy and equipped with sockets that are adjustable vertically, with respect to reflector or globe. These fixtures were described in the issue of November 21. Other types of fixtures manufactured here are designed for large interiors, such as armories, factories, with reflectors designed to distribute light over a large area.

The "Safety" steel boxes are manufactured in various sizes and styles to suit requirements. They are made of heavy sheet steel; all joints are electrically welded, painted with high-grade black enamel paint. These boxes are shipped in standard packages, consisting of 10 boxes of the same sizes and type.

Another manufacturing item recently added is the "Safety-First" fire extinguisher. It is the result of an exhaustive study, and it embodies the practical features that are essential to a dependable fire extinguisher which will safeguard thousands of dollars in-

vested in plant and equipment. This fire extinguisher is a compact, rugged unit, 15 inches high, cylindrical in shape, consisting of seamless brass tube with substantial bronze top and bottom casings, and an ingenious charged pinion which is absolutely fool-proof; in fact, so fool-proof that even the fool can't help operating it effectively when occasions require. This efficient little fire engine throws its non-electric-conductive flame-deadening fluid a distance of 35 feet.

The Electric Operations Company is also agent for incandescent nitrogen-filled lamps; electrically operated washing machines, switches, switchboards, and all kinds of line tools for telegraph, telephone and railroad systems.

One among the latter which may be mentioned is an anchor for transmission-line poles of exceptionally high holding power. This anchor is set entirely by the strain on the guy strand, and needs no tools whatever to set it. The anchor plates are made convex instead of concave, or flat on top, which increases the holding power many fold.

The electric washer, of which the Electric Operations Company has the agency, consists of three distinct units; namely, motor and encased mechanism, wringer and cylinder. These are adjusted to the stationary tub by specially designed clamp locks, easily holding the units immovable. It can be operated from any lamp socket on lighting circuit, either alternating or direct current, and is equipped with a motor of special design and construction. It is constructed with light but durable gears, and the motor with encased mechanism can be used for operating a sewing machine, ice-cream freezer, polisher, electric fan, and general electric household works.

The Electric Operations Company designed, developed and constructed also the "Electric Carrier Railway" for rapid transit of mail and express, and its experimental plant is located at Paterson, N. J. It is equipped to meet the needs of city mail transfer, and has loading and unloading stations and two sidings. This plant was developed and put in operation about a year ago, and since then several plans have been worked out for installation in different cities throughout the country, while the city of Hamburg, Germany, contemplated an extensive system, to be installed on plans worked out by the company. However, owing to the war, the installation has been postponed.

Straps for Securing Receptacles to Conduit Boxes.

In many conduit-wiring installations difficulty has been experienced in finding a ready means of attaching certain types of receptacles to some of the commonly used kinds of outlet boxes. This is equally true of the shallow or pancake type of box and the deep boxes that are used with a cover and without lugs or ears.

This difficulty has been cleverly met by the design of very simple, but effective conduit-box straps. These are made in two sizes, as shown in Figs. 1 and 2, so as to permit their use in shallow and deep boxes. Either of these sizes may be used with or without the fixture stud.

Figs. 1 and 2.—Conduit-Box Straps.

The simple method of securing the straps to shallow and deep boxes is shown in Figs. 3 and 4. In each of these cases the strap is attached to the fixture stud. This method of securing the strap is also shown in Fig. 5 as applied to one of the "BX" type

Fig. 3.—Shallow Box with Strap Secured to Fixture Stud.

of boxes. Fig. 6 and 7 show how the straps can readily be attached to shallow and deep boxes in which a fixture stud is not used.

In all cases these simple straps save considerable time in mounting receptacles directly on a box and make a neat and rigid job. They can be used with quite a variety of receptacles,

Fig. 4.—Strap Secured to Fixture Stud in Deep Box.

not only those made by the manufacturers of these straps, which are made by Pass & Seymour, Incorporated, Solvay, N. Y.

"The House of Klein" Issues a Christmas Book.

Among the holiday trade literature is a booklet entitled "Christmas Gift Suggestions" issued by Mathias Klein & Sons, tool manufacturers, 562 West Van Buren Street, Chicago, Ill.

The booklet has an artistic front cover in colors with two sketches, one of a lineman and another an electrician, each at work and suggestive of tools and their

Fig. 5.—Strap and Fixture Stud in "BX" Box.

application. The inside pages contain illustrations, descriptions and prices of a number of linemen's, electricians' and construction tools suitable for practical Christmas gifts. Messrs. Klein announce that the booklet is for gratuitous distribution on request.

As 1914 draws to a close, it adds another year to the long successful business career of the "House of Klein." This firm was established in 1857 and is

Fig. 6.—Strap Secured to Shallow Box without Fixture Stud.

said to be the pioneer manufacturer of tools for the lineman and electrical worker generally. Three generations of the Klein family are today conducting the business, the founder, Mathias Klein, be-

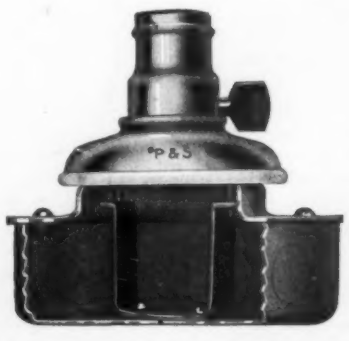


Fig. 7.—Strap Mounted in Deep Box without Fixture Stud.

ing in his eighty-eighth year and still alert and active in the inventive and manufacturing end of this progressive business.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABLES, Armored.—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Flexible armored cable, single wire or multiple conductors.

Marker: trademark (Circle T) stamped every 2.5 inches on exterior of armor.

Armored cables shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved October 26, 1914.

CANOPY INSULATORS.—Kelting Electric Company, 119 Pearl Street, New York, N. Y.

"Knu" canopy insulator, consisting of folded fiber strip to be placed over edge of canopy.

Commercial products of this class, which are regularly examined and tested under the supervision of Underwriters' Laboratories, Incorporated, bear uniform labels.

Approved November 10, 1914.

CONDUIT BOXES.—Sprague Electric Works of General Electric Company, 527 West Thirty-Fourth Street, New York, N. Y.

"S. E." For rigid conduit: stamped steel, catalog Nos. 6770-6787, inclusive.

Covers of stamped steel, cast-iron or porcelain suited for above boxes.

Approved October 26, 1914.

CONDUIT, Flexible (Steel).—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Trademark: Circle T stamped at intervals of approximately 6 inches.

Conduit shown by tests and examinations conducted by Underwriters' Laboratories, to be in accordance with requirements of the National Board of Fire Underwriters, has label attached to each length.

Approved November 4, 1914.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—The **Gillette-Vibber Company,** 32 Maple Avenue, New London, Conn.

"Gee-Vee." Service entrance caps, catalog Nos. 6012-6034.

Two-piece fittings with composition bushing and with threaded hubs for attaching to rigid conduit.

Approved October 15, 1914.

CURRENT TAPS.—Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin" 660 watts, 250 volts.

Combinations of a swiveling Edison shell attachment plug with brass-shell sockets. Multiple, catalog No. 822.

Approved October 16, 1914.

FIXTURES. — Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin."

Series clusters, 250 volts; for mogul-base lamps, catalog No. 0664-½.

Ceiling fixtures, catalog Nos. 2377, 2378, 4300-14, inclusive.

Approved October 20, 1914.

FIXTURES.—Southern Nickel Works, 305 North Graham Street, Richmond, Va.

Fixtures shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of National Board of Fire Underwriters—have labels attached.

Approved November 9, 1914.

FIXTURES.—Winston Electric Construction Company, 12 North Seventh Street, Richmond, Va.

Fixtures shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved November 3, 1914.

FIXTURES, Supports for.—Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, N. Y.

Hollow center galvanized malleable-iron studs for supporting electric fixtures in outlet boxes, ⅜ inch, catalog No. 6198; ½ inch, catalog No. 6199.

Approved October 20, 1914.

FUSES, Plug.—Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn, N. Y.

"M. E. Co." Edison plug fuses, 3-30 amperes, 125 volts, with porcelain heads slotted for sealing.

Approved October 29, 1914.

GROUND CLAMPS.—Star Electric Company, 422 South Fourth Street, Philadelphia, Pa.

"S. G. C." ground clamp for use with No. 10 B. & S. gauge ground wire.

A single-piece clamp of copper, provided with suitably spaced holes and with galvanized bolt, nut and washer for clamping to rigid conduit. Adjustable for use with conduit up to one inch in size. One end of clamp is tinned and channeled to form equivalent of a lug for soldering to ground wire.

Approved October 31, 1914.

HEATERS, Electric.—General Electric Company, Schenectady, N. Y.

"G. E." heaters, 95-250 volts.

Water heaters; type L-52, 150-500 watts.

Chafing dishes; types L-49, L-51, 600 watts.

Toasters; type D-36, 550-3500 watts.

Disk stoves; type D-60, 225-900 watts.

Range; type R-1, 3600 watts.

Air heater; types A-47, A-51, 1200-5000 watts.

Luminous radiators; types A-28, A-29, A-45, A-46, 750-1500 watts.

Individual contact plugs, catalog No. 148683, for use with "G. E." heaters.

Approved October 22, 1914.

HEATERS, Electric.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

"Westinghouse" 100-250 volts.

Vulcanizer and rheostat, style No. 138187-8.

Approved October 22, 1914.

HICKEYS.—Pittsburgh Valve and Fitting Company, Barberton, O.

Malleable-iron hickeys in standard sizes.

Approved October 23, 1914.

RECEPTACLES, for Attachment Plugs.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" flush.

Six amperes, 250 volts, 12 amperes, 125 volts, catalog No. 507 with plate.

Ten amperes, 250 volts, three-pole, catalog No. 475; with plug, catalog No. 476.

Ten amperes, 250 volts, with plugs, catalog No. 494.

Approved October 21, 1914.

RECEPTACLES, Standard. — The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

"Arrow E" brass-shell.

Molding, metal or wood.

Key, catalog Nos. 7513, 7516-18-32, 8046-48-66.

Key, 660 watts, 250 volts, catalog Nos. 7516W, 7518W, 7532W, 8046W, 8048W, 8066W.

Keyless, catalog Nos. 7514, 7517-19-33, 8047-49-67.

Pull, catalog Nos. 4515, 4517-19-33, 8523-24-33.

Link-fuse bases, cleat and concealed, 2 amperes, 125 volts.

Key, 600 watts, catalog Nos. 8050W, 8052W, 68226W, 68227W.

Also all the above types with shade-holders attached, key types with composition or insulated metal key.

Approved October 16, 1914.

RECEPTACLES, Standard.—Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin." Keyless, porcelain shell. 1500 watts, 600 volts, catalog Nos. 693, 695, 696, 698.

Approved October 15, 1914.

RECEPTACLES, Standard.—The Bryant Electric Company, Bridgeport, Conn.

Keyless, porcelain-shell.
Sign, catalog No. 61988—special.
Approved October 27, 1914.

RECEPTACLES, Standard.—Crouse-Hinds Company, Syracuse, N. Y.

"C. H. Co." 660 watts, 250 volts.
Condulet, catalog No. G9397.
Approved October 15, 1914.

RHEOSTATS.—Bausch & Lomb Optical Company, Rochester, N. Y.

Rheostats consisting of wire-wound resistance coils in perforated sheet-metal cases designed primarily for use with projection apparatus.

Fixed-resistance type, 110 volts, 15 amperes.

Variable-resistance type, 110 volts, 15-35 amperes.

The general design and construction of these rheostats are considered satisfactory. It should, however, be noted that any device of this character, even under normal conditions, reaches temperatures which make it necessary to avoid installation near combustible material.

Approved October 24, 1914.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H" self-starters for 110, 220, 440, 500 and 550 volts, alternating and direct current, consisting of individual and grouped switches for cutting out starting resistance, as described in manufacturer's bulletins.

Direct-current self-starters; bulletin No. 6159.

Alternating-current self-starters; bulletin No. 9615.

This manufacturer is prepared to supply with these devices, metal cases inclosing all current-carrying parts.

Approved October 26, 1914.

SOCKETS, Standard.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H," 660 watts, 250 volts.
Brass-shell.
Push-button, catalog No. 7502.
Keyless, catalog Nos. 7503, 7513.
Approved October 15, 1914.

SOCKETS, Standard.—Best Electric Company, Fifty-first and Harrison Streets, Pittsburgh, Pa.

"Best" brass-shell.
Key, catalog Nos. 1050-57 inclusive, 1100-07 inclusive, 2025-32 inclusive.
Keyless, catalog Nos. 1000-07 inclusive, 2000-07 inclusive.
"Best" porcelain-shell.
Key, catalog Nos. 1275-80 inclusive, 2150-55 inclusive.
Keyless, catalog Nos. 1250-55 inclusive, 2125-30 inclusive.
"Best" composition-shell.
Key, catalog Nos. 1525-30 inclusive, 2275-80 inclusive.
Keyless, catalog Nos. 1475-80 inclusive, 2250-55 inclusive.
Approved October 15, 1914.

SOCKETS, Standard.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" metal-shell sockets.

Pull, 250 watts, 250 volts, catalog Nos. 4402, 4404, 4406.

Twin sockets, catalog Nos. AA-17 to AH-17 inclusive, AK-17 to AN-17 inclusive, AP-17, AR-17 to AU-17, inclusive.

Also above types with shadeholders attached.

Approved November 14, 1914.

SOCKETS, Candelabra. — Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" 75 watts, 125 volts.
Keyless, brass-shell, catalog No. 5753.
Approved November 2, 1914.

SOCKETS, Standard. — Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin" brass-shell.

Keyless. Uni-shell, catalog Nos. 4320, 4322, 4324, 4326, 4328, 4330, 4332, 4334.

Keyless, 660 watts, 600 volts, catalog Nos. 4400, 4402, 4404, 4406, 4408, 4410, 4412, 4414, 4416, 4418, 4420, 4422.

Approved November 14, 1914.

SOCKETS, Standard.—General Electric Company, Schenectady, N. Y.

"G. E." brass-shell.

Key, 250 watts, 250 volts, catalog Nos. GE228-30 inclusive. GE251-53 inclusive.

Key, 660 watts, 250 volts, catalog Nos. GE399-406, inclusive, GE412.

Keyless, 660 watts, 250 volts, catalog Nos. GE035, GE235-37 inclusive, GE257-59 inclusive.

Pull, 250 watts, 250 volts, catalog Nos. GE302, GE305, GE308, GE311, GE314, GE317, GE320, GE323.

Also above types with shadeholders attached.

Approved November 13, 1914.

SOCKETS, Weatherproof.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." 1,500 watts, 600 volts, catalog No. 522.

Approved November 5, 1914.

SWITCH BOXES.—Federal Electric Company, P. O. Box 1406, Pittsburgh, Pa.

Pressed-steel boxes in single units for use with flexible tubing, or rigid conduit. These boxes have one removable side, and fastenings by which a gang box of any desired number of units can be obtained.

Approved October 27, 1914.

SWITCHES, Automatic.—F. A. Boedtcher, 413 West Forty-first Street, New York, N. Y.

Safety elevator door switch, 2 amperes, 250 volts. An inclosed, single-pole, spring-opened switch, automatically closed by the elevator door and connected in series with the solenoids or magnets of the elevator motor-controller, so that the car cannot be started until the door is properly closed.

Approved October 24, 1914.

SWITCHES, Automatic.—Empire Engineering & Supply Company, 229 Fulton Street, New York, N. Y.

"Empire" time switch.

Type A, two-pole, 30 amperes, 250 volts.

Type AA, three-pole, 30 amperes, 250 volts.

Type C, two-pole circuits, 30 amperes, 125 volts, and 10 amperes, 125 volts.

A special switch or switches mounted on a slate base, inclosed in a metal cabinet and operated mechanically by means of a clock, which is furnished as part of the apparatus.

Approved October 20, 1914.

SWITCHES, Combination Cutout.—Metropolitan Engineering Company, 1252 Atlantic Avenue, Brooklyn, N. Y.

"M. E. Co." meter-testing block, 0-100 amperes, 250 volts, catalog Nos. 131, 132; porcelain bases carrying spring contacts for meter-testing plugs.

"M. E. Co." protective service switch boxes and meter boards, 0-30 amperes, 125 volts. Catalog No. 137, cabinet with plug-fuse cutout and meter-testing base and snap switch. Also catalog No. 138, without switch, for use only in connection with a fused double-pole switch.

Approved November 6, 1914.

SWITCHES, Combination Cutout.—Metropolitan Engineering Company, 1252 Atlantic Avenue, Brooklyn, N. Y.

"M. E. Co." protective service switch boxes and meter boards, 61-100 amperes, 250 volts, catalog Nos. 147 and 148, cabinets with meter-testing clips and two or three-pole Colonial-type fuses.

These devices are not considered suitable for use in connection with secondaries not properly grounded, since they are not so designed that they can be promptly opened by a single operation.

Approved November 7, 1914.

SWITCHES, Door.—General Electric Company, Schenectady, N. Y.

"G. E." 3 amperes, 250 volts, 6 amperes, 125 volts.
Catalog No. GE 273, normally closed.
Catalog No. GE274, normally open.
Approved November 11, 1914.

SWITCHES, Knife.—Connecticut Electric Manufacturing Company, Bridgeport, Conn.

Type C, 250 and 600 volts, up to and including 200-ampere sizes.

Approved October 31, 1914.

SWITCHES, Pendent Snap.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins."
Two-button type.
Single-pole, 3 amperes, 250 volts, 6 amperes, 125 volts, catalog Nos. 2572, 2573, 2574, 2592.
Approved October 31, 1914.

WIRE CONNECTOR. — Sharfink Electric Manufacturing Corporation, 84 Walker Street, New York, N. Y.

"Nosplice" wire connector; consisting of a steel sleeve containing set-screw clamping jaws and inclosed in a molded composition insulating casing.

These connectors are judged to be suitable for use in connecting fixture wires to the supply circuits at fixture outlets, and where open to view for connecting motor leads to supply circuits.

They are not considered satisfactory as a substitute for soldered joints in general wiring.

They will not reliably hold in the same end of the connector wires of different sizes or both stranded and solid wires.

They are not suitable for use with wires larger than No. 12 B. & S. gauge.

Approved October 22, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

HALLOWELL, ME.—Marston Brooks Company will renovate its cotton warehouse and equip it with motorized machinery for the manufacture of paper boxes for use in the shoe business. The plant will be operated by the Oscar Childs Company.

BABYLON, L. I., N. Y.—A merger is reported under way of the Babylon Electric Light Company with the Long Island Lighting Company, which latter company operates in various sections of Suffolk County. The object of the merger is to give the Long Island Lighting Company control of the lighting field from the Brookhaven town line to the Nassau County line in Suffolk.

ALLENTOWN, PA.—In the financial budget prepared by the city commissioners for the coming year, there is included an appropriation of $12,500 for the purchase and installation of an electric pump, the first step in the electrification of the water system as proposed by council fully seven years ago when an electrical engineer prepared elaborate plans for such a plant. Under the Department of Public Affairs, one item calls for an appropriation of $3,500 for underground cable and if this be decided on finally, the underground fire-alarm system with the laying of many hundred feet of conduits from streets to points where fire-alarm boxes are now located, will be completed. Mayor Chas. W. Rinn is Superintendent of Public Affairs, and R. J. Wheeler is Superintendent of Parks and Public Property, under which the water plant is operated.

ALLENTOWN, PA.—Kaltenbach and Stevens, silk manufacturers, have awarded to the F. L. Dillon Construction Company, the contract for a $40,000 addition to their large mill here. About 100 horsepower in power and lighting apparatus will be installed. The electrical construction will be undertaken by their own employees and when in operation will be supplied with power from the lines of the Lehigh Valley Light and Power Company.

EASTON, PA.—An ordinance has been introduced into city council providing for a four per cent bond issue to the amount of $16,300, of which $4,200 will be used for extensions and improvements of the street lighting system.

FREEMANSBURG, PA.—The borough council has passed an ordinance giving authority to the Freemansburg Electric Light and Power Company, to supply light, heat and power by electricity to the borough and adjacent territory. The company has entered into a street lighting contract with the borough to furnish and supply at least 26 thirty-two candlepower Madza lamps with all appurtenances thereto for a period of five years. Any additional units supplied during the life of the contract will be under the same conditions as those originally contracted for.

UPPER SANCON TOWNSHIP, PA.—The Upper Sancon Electric Company, a subsidiary of the Lehigh Navigation Electric Company, has been granted a charter to supply light, heat and power by means of electricity in Upper Sancon Township. The company is capitalized at $10,000.

LOGAN, W. VA.—The Logan Power & Light Company has been incorporated with a capital of $1,500,000, and is to erect a power house in Logan County which will have a capacity of 10,000 kilowatts. The company will build 75 miles of transmission lines.

NORTH CENTRAL STATES.

HAMILTON, O.—The city lighting department is considering extending the system of cluster lights on Main Street for some distance, making a total of one mile lighted by these globes. L.

YOUNGSTOWN, O.—Co-operating with the city's plan to construct a boulevard lighting system on Federal Street, the Chamber of Commerce will circulate petitions to be signed by abutting property owners, by which they will bind themselves for their share of the maintenance cost of the lights, after which the council can proceed with the work. L.

PEORIA, ILL.—A resolution introduced in the Peoria city council brings up the question of the feasibility of the city erecting a municipal electric light plant. The resolution provides for the appointment of a committee of five aldermen to investigate the matter.

SPRINGFIELD, ILL.—The question of turning over the municipal lighting plant to the Springfield Utilities Company and signing a contract for the lighting of the streets of the city for a period of 10 years may be submitted to a vote of the people by referendum petition.

JANESVILLE, WIS.—The Janesville Electric Company has increased its capital from $100,000 to $20,000.

RACINE, WIS. — The Standard Electric Works has filed an amendment to its charter, changing its name to the Arnold Electric Company, and increasing its capital stock from $25,000 to $100,000, in 1,000 shares of $100 each. The papers are signed by George C. Schmitz, president, and Joseph A. Schmitz, secretary.

SLYTON, MINN.—A petition is being circulated for a white way system to cost about $2,175. Address village clerk.

GARWIN, IOWA.—The city council has voted to call a special election for December 22, to grant a franchise to the Garwin Electric Company to connect with the Iowa Light Company lines about three miles west of town, where they will run from Montour to Gladbrook. If a vote is carried service will begin about January 1, 1915.

TOPEKA, KANS.—Petitions are being circulated to submit a proposition to vote for a bond issue for the installation of a municipal lighting system to retail electric current for commercial and domestic uses.

SOUTH CENTRAL STATES.

JEFFERSONVILLE, KY.—Chester P. Wilson, of Indianapolis, president of the United Gas & Electric Company, has opened direct negotiations with the light and gas committee of the city council as to a new contract for street lighting in Jeffersonville. When the old contract expired some time ago the city contracted with Owen B. Carr to supply the service, but the courts held the contract invalid and the United Company has been furnishing the current. The council committee is considering replacing the old arc lights with a tungsten incandescent service and this point is being considered.

SCOTTSVILLE, KY.—The Scottsville electric light plant has passed into the hands of J. W. Hood, who has purchased the lease of Mays & Schlinker which has nine years yet to run. The plant, renewed a year ago by the former lessees, is thoroughly up to date and efficient.

WESTERN STATES.

LA JUNTA, COLO.—Steps have been taken toward building a municipal electric light plant for the city. The matter of a $7,000 bond issue will be voted upon at the spring election.

SALT LAKE CITY, UTAH.—John Mullen, a veteran miner of the Park City district, and associates of Salt Lake, have practically completed arrangements for the installation of an electric hoist on his Altmore property, located three miles west of Springdale, in Nye County, Nevada. Mr. Mullen has been using a windlass and the present depth of the shaft makes it practically impossible to proceed further with that method of hoisting. He is confident that the Altmore will become one of the big producers. A contract has been entered into with the power company at Bishop for the necessary electric power. Shipments are to be started as soon as the work of installing the hoist has been completed.

TUCSON, ARIZ.—A bond issue for street lighting will be voted upon at the city election on December 14 together with other issues totaling $239,000.

PILOT MOUND, MAN.—The board of trade has endorsed a proposal for an electric light plant, and the town council will be asked to grant a 20-year franchise for erecting the plant free from taxation.

VANCOUVER, B. C.—Preparations are being made by City Electrician Fletcher to carry out the recommendations of the Civic Bridges and Railways Committee of the council regarding the lighting of the new Hasting Street viaduct. New nitrogen-filled tungsten lamps will be used, and will result in a considerable saving to the city. Bids for furnishing the necessary equipment, ornamental standards, lights etc., and for the installation of same will be received about the first of the year, according to reports. O.

EVERETT, WASH.—A committee, composed of members of the Riverside Business Men's Association, is investigating the proposition of installing an incandescent lighting system on Hewitt Avenue, east of the viaduct. The matter will be taken up before the council as soon as the committee reports back. O.

SPOKANE, WASH.—Petitions involving expenditure of $110,000 in lighting of Sprague Avenue, from Division Street, with electrolier lighting system, will be filed with Commissioner of Public Utilities C. M. Fassett.

TACOMA, WASH.—The council at a recent meeting authorized the city attorney to prepare an ordinance to provide for lighting D Street between South Seventh and Seventeenth, similar to the system on Pacific Avenue and C Street. The system cost $17,000. Commissioner of Light and Water, Owen Woods, will shortly receive bids for materials and installation. O.

VANCOUVER, WASH.—J. H. Cunningham, of this city, recently filed with the county auditor, Clarke County, a notice of the appropriation of 500 cubic feet per second of the water of the east fork of the Lewis River. The water is to be used for hydraulic and electric power for municipal lighting, manufacturing and other commercial

ASHLAND, ORE.—Preliminary steps have been taken toward bonding the city for $32,000 for the construction of an auxiliary light plant and the purchase of additional equipment.

SILVERTON, ORE.—The installation of a complete system of electric lighting, same to include the placing of cluster lights in the business section and single lights in the residence district, is being promulgated by the city council, and in line with this, a special committee has been appointed to draft plans for the proposed work. Bids for furnishing the equipment and installing the same will be received in the immediate future. The council is also considering asking bids for furnishing current for the system on a five-year contract. O.

LOS ANGELES, CAL.—An ordinance has been passed creating a conduit district, which includes all portions of Los Angeles Street, between Alameda Street and the southerly line of Plaza Street, and prohibiting the maintenance of poles and wires in that section.

SAN FRANCISCO, CAL.—Recommendation has been made to the Board of Supervisors that the sum of about $28,000 be drawn from the Municipal Railway fund for lighting Van Ness Avenue, it being planned to attach the lights to the railway trolley poles.

WEAVERVILLE, CAL.—Bids will be received by the supervisors of Trinity County up to January 7 for a franchise to erect poles, etc., for the transmission of electricity in the county as applied for by the California-Oregon Power Company.

PROPOSALS.

VACUUM SYSTEM.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until December 18, for a vacuum cleaning system in the United States court house, postoffice, etc., at Louisville, Ky., in accordance with drawing and specifications, copies of which may be had at the office of the supervising architect or the custodian.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be opened at the office of the Supervising Architect, Treasury Department, Washington, D. C., on January 4, 1915, for interior lighting fixtures for the United States post office at La Junta, Colo. Drawings and specifications may be obtained from the custodian of site at La Junta, Colo., or at the office of the supervising architect.

ELECTRIC CRANES.—Sealed proposals indorsed "Proposals for Electric Traveling Cranes" will be received at the bureau of yards and docks, Navy Department, Washington, D. C., until December 12, 1914, for three electric traveling shop cranes at the naval station, Pearl Harbor, Hawaii. Plans and specifications may be obtained on application to the bureau. H. R. Stanford, chief of bureau.

ELECTRIC LIGHT PLANT.—Sealed proposals will be received by the mayor of Bay Minette, Ala., until December 15, for furnishing materials, machinery and for constructing a complete water works system, sewer system and electric plant. Plans and specifications are on file in the office of the mayor. The electric plant will include one 50-kilovolt-ampere, 1,200 revolutions per minute, belted, three-phase, 60-cycle, 2,300-volt generator, two-panel switchboard, exciter, and two miles of pole line work complete. W. D. Stapleton, mayor.

ELECTRICAL SUPPLIES.—Sealed proposals will be received at the office of the quartermaster, Fort Bayard, N. M., until December 10, for furnishing miscellaneous quantity of electrical supplies, including three choke coils, three lightning arresters, one watt-hour meter, three lightning arresters, one water weigher, one steam gauge, one pump, one transformer, three standard wrenches, four pipe wrenches, plier, three screwdrivers, six files and nine twist drills. For information address C. F. Ellefson, second lieutenant, 7th Cavalry, acting quartermaster.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file number) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 14,447. ELECTRICAL SUPPLIES.—An electric light company in South America informs an American consular officer that it would like to receive catalogs from American manufacturers of electrical appliances of all kinds, except power plant equipment. Articles suitable for household use are particularly desired.

NO. 14,474. ELECTRICAL GOODS.—A South American firm wishes to get in touch with American manufacturers of electrical goods and equipment. Correspondence may be in English.

NO. 14,504. ADVERTISING DEVICES, ETC.—A business firm in the Dominion of Canada desires to be put in touch with American manufacturers of advertising novelties and devices, household and office necessities, and electrical and mechanical devices.

NO. 14,522. ELECTRIC MOTORS AND ACCESSORIES, LATHES, TOOLS, STEEL CABLES, ETC.—A large firm abroad wishes to correspond with reliable firms in the United States manufacturing the above articles. The consul states that it can furnish excellent references. Correspondence may be in Russian, French or German.

NO. 14,543. DRY BATTERIES.—A foreign business firm informs an American consular officer that it wishes to correspond with American manufacturers of dry batteries.

NO. 14,604. ARC-LAMP CARBONS.—A consul reports that a firm in his district is anxious to be placed in communication with American manufacturers of arc-lamp carbons. The concern in question is a large buyer of this class of goods as well as of other electrical accessories. Owing to the disturbed commercial conditions in Europe the firm must seek supplies elsewhere.

NO. 14,618. ELECTRIC MACHINERY, DYNAMOS, TRANSFORMERS, MOTORS, ETC.—A merchant of high standing has requested the American consul to place him in communication with American manufacturers of dynamos, transformers, motors, switches, and materials for electrical installation, such as lamps and insulating tubing, electroliers, electric heaters, water boilers, and general domestic appliances. The consul states that this firm, with its several branches, does an extensive business. Correspondence may be in English.

NO. 14,626. ELECTRIC GLASSWARE, FLASH LAMPS, ETC.—A firm abroad is desirous of communicating with manufacturers in the United States of electric glassware, flash lamps, and batteries for such lamps.

NEW PUBLICATIONS.

BUREAU OF STANDARDS.—The following scientific papers of the Bureau of Standards, Washington, D. C., have lately appeared: No. 223. "The Testing of Potentiometers," by Frank Wenner and Ernest Weibel; No. 224. "The Emissivity of Metals and Oxides," by G. K. Burgess and P. D. Foote; No. 225. "Adjustments of the Thomson Bridge in the Measurement of Very Low Resistances," by F. Wenner and E. Weibel.

MERCHANT MARINE.—The American Steamship Association, 17 Battery Place, New York City, has issued a pamphlet entitled "Restoration of the American Merchant Marine." This shows by comparative figures the difficulties under which the American ship suffers in international trade and the futility of expecting an American merchant marine to be built up if registry is confined to American-built vessels and present legal difficulties continued.

NEW INCORPORATIONS.

NEW YORK, N. Y.—The Nichols Electric Company has been incorporated with a capital of $25,000. Incorporators: Nicholas Macaluso, 1 West Broadway, New York; Joseph Cerami, New York; Josephine Giaimo, Paterson, N. J.

NEW YORK, N. Y.—Standard Telephone Appliances, Incorporated. Electrical appliances, etc. Capital, $50,000. Incorporators: George B. Coddington, Arthur E. Tucker and Stallo Vinton, all of 41 Park Row, New York City.

HAMILTON, IND.—The Quincy & Hamilton Electric Railway Company has been incorporated with a capital of $525,000 to build an electric railway from Quincy to Hamilton. The incorporators are Charles S. Carscallen and others.

MOBILE, ALA.—The D'Olive Electric Company has been incorporated to engage in a general electric supply and repair business. The company is capitalized at $2,000. The officers and incorporators are: President, Charles S. Mode, Chicago; vice-president, Harry N. Alter, Chicago; secretary-treasurer and general manager, Louis O. D'Olive, Mobile.

FINANCIAL NOTES.

Harris, Forbes & Company and Perry, Coffin & Burr have concluded negotiations for the purchase of $1,200,000 first-mortgage five-per-cent 30-year bonds of the Ohio Light & Power Company, a subsidiary of the American Gas & Electric Company, dated May 1, 1914. It is expected that these bonds will shortly be offered to investors at 90 and interest.

The Consumers' Power Company, which controls the electric light and power business of a large portion of the state of Michigan, including some of the most important manufacturing centers in the state, has sold approximately $500,000 first-lien and refunding five-per-cent bonds to Harris, Forbes & Company, N. W. Harris & Company, and Perry, Coffin & Burr, of Boston, and the Harris Trust & Savings Bank, of Chicago. These bonds are part of an outstanding issue of $12,936,000, secured by a direct mortgage on water rights and, through the deposit of collateral, by a first lien on all of the properties of eight constituent companies and on the properties of three additional constituent companies subject to their outstanding bonds. The company's income account continues to show satisfactory increases, net earnings for the year ended September 30 being more than twice the bond interest requirements on all outstanding bonds.

Dividends.

	Term.	Rate.	Payable.
Am. Pr. & Lt. Com... ..		1%	Nov. 25
Brooklyn Rapid Tran...	Q	1.5%	Jan. 1
Chicago Telephone	Q	2%	Dec. 31
Conn. River Pr. pf...	S-A	3%	Dec. 1
Eastern Tex. Elec. pf.	S-A	$3	Jan. 1
Mass. Elec. pf.....	S-A	$2	Jan. 1
Montana Power pf.....	Q	1.75%	Jan. 2
Montana Power com....	Q	0.5%	Jan. 2

Reports of Earnings.

CLEVELAND, SOUTHWESTERN & COLUMBUS RY.

	1914	1913
September gross	$ 113,018	$ 114,658
Net earnings	48,279	48,295
Surplus after charges...	15,734	15,967
Nine months' gross.....	950,589	939,426
Net earnings	382,955	377,542
Surplus after charges...	91,644	93,078

YOUNGSTOWN & OHIO RIVER RAILROAD.

	1914	1913
September gross	$ 27,174	$ 25,017
Net after taxes.....	10,224	9,550
Surplus after charges...	6,057	5,383
Three months' gross....	76,956	75,081
Net after taxes.....	28,842	27,622
Surplus after charges...	16,342	15,122

AMERICAN GAS & ELECTRIC.

Five subsidiaries of the American Gas & Electric Co. report for the twelve months ended September 30, 1914, as follows:

ATLANTIC CITY ELECTRIC:

	1914	1913
Gross earnings	$ 473,714	$ 452,630
Net after taxes.....	234,528	227,818
Surplus after charges...	127,919	118,943

CANTON ELECTRIC:

Gross earnings	$ 510,856	$ 388,204
Net after taxes.....	242,489	196,280
Surplus after charges...	178,350	139,730

ROCKFORD ELECTRIC:

Gross earnings	$ 490,163	$ 449,190
Net after taxes.....	264,384	239,483
Surplus after charges...	171,577	150,375

SCRANTON ELECTRIC:

Gross earnings	$1,084,548	$ 874,264
Net after taxes.....	648,260	524,467
Surplus after charges...	406,513	331,949

WHEELING ELECTRIC:

Gross earnings	$ 337,345	$ 299,061
Net after taxes.....	158,996	137,985
Surplus after charges...	90,358	81,970

NORTHERN OHIO TRACTION & LIGHT.

	1914	1913
September gross	$ 311,656	$ 289,022
Net after taxes	116,289	119,802
Surplus after charges...	64,862	72,271
Balance after preferred dividends	49,757	59,489
Nine months' gross.....	2,728,558	2,444,698
Net after taxes.....	1,065,541	973,662
Surplus after charges..	610,295	560,465
Balance after preferred dividends	474,863	449,584

CAROLINA POWER & LIGHT.

The Carolina Power & Light Co. reports for the twelve months ended September 30, 1914, as follows:

	1914	1913
Gross earnings	$1,245,939	$1,071,402
Operating expenses.....	656,040	554,039
Net earnings	589,899	517,263
Interest charges	389,119	356,059
Surplus	200,780	161,204
Preferred dividends	84,122	79,590
Balance	116,658	81,614

SAN JOAQUIN LIGHT & POWER.

	1914	1913
September gross	$ 157,123	$ 154,293
Net after taxes	100,224	63,311
Surplus after charges...	57,887	31,750
Nine months' gross.....	1,392,390	1,279,463
Net after taxes.....	881,098	681,041
Surplus after charges..	506,668	371,150

CONSUMERS POWER OF MICHIGAN.

	1914	1913
September gross	$ 275,524	$ 253,340
Net	164,724	113,993
Surplus after charges..	69,304	28,999
Twelve months' gross...	3,377,089	3,064,186
Net	2,117,925	1,635,840
Surplus after charges...	987,446	712,206

PERSONAL MENTION.

MR. HENRY GRENACHER, for several years connected with the engineering department of H. M. Byllesby & Company, has been appointed efficiency engineer for the Byllesby properties, in which capacity he will visit the various plants and co-operate with the local managers in approving efficiency of station operation.

PROFESSOR JOHN EDSON SWEET, of Syracuse, N. Y., has been awarded the John Fritz medal "for his achievements in machine design and pioneer work in applying sound engineering principles to the construction and development of the high-speed steam engine." The presentation took place in the auditorium of the Engineering Societies Building, New York, on Wednesday, December 2.

MR. B. E. SUNNY, president of the Chicago Telephone Company, in his interesting address at the recent meeting of the Telephone Pioneers of America, at Richmond, Va., called attention to the fact that Richmond was the birthplace of the electric trolley, as it was there that Mr. Frank J. Sprague installed the first electric line during the winter of 1887 and 1888, which has been in continuous service ever since. In addition to being one of the earliest and strongest factors in telephone development, Mr. Sunny devoted several years to electric lighting and electric railway advancement and is still largely interested in these branches of the industry.

MR. JOHN W. GRAHAM, of Twin Falls, Idaho, will fill the vacancy left on the Idaho public utilities commission by the recent resignation of Judge D. W. Standrod. Governor Haines announced the appointment of Mr. Graham. Mr. Graham has been practicing law in Idaho for the past four years. He is 41 years of age and a native of Canada, but was educated at the University of Nebraska. He practiced his profession in Fremont, Dodge County, Neb., and was for four years prosecuting attorney of that county, and had altogether fifteen years experience as a lawyer. The appointment, which he has just accepted, will hold until four years from the first Monday of January, 1915, since Judge Standrod held the long term on the utilities commission. "I tendered the appointment of Mr. Graham only after I had given the matter long and thorough consideration," said Governor Haines, "and I have the utmost confidence in his ability and his fitness for the place. I am more than pleased that he has accepted the appointment. It was a question, however, not of finding a man who would accept the office, but one who could fill it. I am sure Mr. Graham is the right man."

MR. WILLIAM F. BAUER has been appointed manager of the Chicago office, Edison Storage Battery Company, succeeding Charles B. Frayer who retired November 30 to devote himself to private interests. Mr. Bauer is a pioneer in the storage-battery field and has been a familiar figure in railway and electrical circles of Chicago since he went there in 1906 as sales engineer of the Electric Storage Battery Company. In 1889 he was the electrician in charge of the original train lighting equipment of the Chicago Limited of the Pennsylvania Railroad, a lighting system designed by his father, then chief electrician of the Pullman Company at Chicago. Later, after practical experience with the old Electric Accumulator Company, the Westinghouse Electric & Manufacturing Company, and the Pullman Company, he became train electrician of the Lake Shore Limited in the employ of the Wagner Palace Car Company. In 1901 he joined the forces of the Consolidated Railway Electric Lighting and Equipment Company and two years later was appointed chief electrician of the Missouri Pacific Railroad in charge of car lighting. Mr. Bauer has been with the Edison Storage Battery Company about a year as assistant manager of the railway department. He is president of the Railway Electrical Supply Manufacturers' Association, an organization in which he has been active since its formation.

OBITUARY.

MR. JOHN C. LOTT died at his residence in Freeport, Long Island, on November 24. Mr. Lott installed the first electric light plant at Freeport and Rockville Center, Long Island. He was manager of the New York office of the Fort Wayne Electric Works, a member of the American Institute of

Electrical Engineers, and well known throughout the electrical business in the eastern states.

MRS. WALTER P. PHILLIPS died at her home in Bridgeport, Conn., on November 29, in her sixty-eighth year. She is survived by her husband, a son, Albert C. Phillips, two sisters and two brothers. Mrs. Phillips was the wife of Walter P. Phillips, a well known pioneer telegrapher and formerly general manager of the United Press. Mr. Phillips is now manager of of the advertising department of the Columbia Graphophone Company, Bridgeport, Conn.

MR. DOUGLAS S. MARTIN died last week at the Boulogne Hospital, France, from shrapnel wounds received at the battle of Messines on the Belgian border. Soon after his graduation as an electrical engineer from the Central Technical College, London, Mr. Martin came to this country and became editor of the *General Electric Review*. He later made an extended trip to the Pacific coast and upon returning east joined the editorial staff of the *Electrical World* at New York. Mr. Martin left New York early in August to enroll in the mounted forces of Great Britain. He was 27 years of age. He had made a great many firm friends in this country who will greatly deplore his untimely passing away. His brother is Mr. T. C. Martin, secretary of the National Electric Light Association.

MR. CHARLES E. HANSELL, Indianapolis, Ind., assistant manager of The Esterline Company of that city, died on November 25 as the result of accidental injuries. Mr. Hansell left his office for his home at 5.30 Tuesday evening, November 24, in his motor car, and while en route the automobile was struck by a city street car, inflicting the injuries which resulted in Mr. Hansell's death the following morning. Mr. Hansell was born and reared at Medaryville, Ind., and was at the time of his death 31 years of age. He was graduated from the electrical engineering department of Purdue University in 1907, and shortly after entered the employ of the Western Electric Company at Chicago. Later he was electrical engineer for the Duncan Electric Company, LaFayette, Ind., and three years ago entered the employee of The Esterline Company, then at LaFayette, as assistant manager and instrument engineer. Besides being known to a wide circle of immediate friends he was recognized as an authority on electrical instruments and meters. He was a man of untiring energy, and of great capacity for work. He is survived by his widow and five children, the oldest being 12 and the youngest 2 years of age. The funeral services were conducted at his boyhood home at Medaryville, on Friday, November 27.

DATES AHEAD.

American Mining Congress. Seventeenth annual session, Phoenix, Ariz., December 7-11. Secretary, J. F. Callbreath, Denver, Colo.

Electrical Supply Jobbers' Association. Quarterly meeting, Tutwiler Hotel, Birmingham, Ala., December 7-10. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Empire State Gas and Electric Association. Albany, N. Y., December 10-11. Secretary, C. H. B. Chapin, 29 West Thirty-ninth Street, New York City.

International Exposition of Safety and Sanitation. Grand Central Palace, New York, N. Y., December 12-19.

American Association for the Advancement of Science. Annual meeting, Philadelphia, Pa., December 28, 1914, to January 2, 1915. Secretary, L. O. Howard, Washington, D. C.

Western Association of Electrical Inspectors. Annual meeting, Minneapolis, Minn., January 26-28, 1915. Secretary, W. S. Boyd, Chicago, Ill.

With the Electrical Manufacturers

The Beardslee Chandelier Manufacturing Company, Chicago, Ill., has published a handsome catalog describing and illustrating a modern and exclusive line of Beardslee chandelier effects featuring the Beardslee patented Old Colony design which typifies the pleasing decorative styles of Colonial days.

The Electric Machinery Company, Minneapolis, Minn., recently added two new buildings to its factory, which will increase its capacity over 30 per cent. The company has this year done a greatly increased business, as is evidenced by the fact that for some weeks past its force has been working 24 hours a day.

The Continental Fibre Company, Newark, Del., is distributing a handsomely printed booklet describing its principal products. These include vulcanized fibre, Bakelite-Dilecto and Continental Bakelite. The characteristics of each of these materials are explained in detail, together with their fields of usefulness.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a handsome circular in the form of a letter, calling attention to the appropriateness of Westinghouse electric ware for Christmas giving. There are illustrated and described 22 pieces of Westinghouse electric ware, with prices ranging from $2.50 to $20.

Edwards & Company, New York, N. Y., is distributing its catalog of electrical house goods. This describes and illustrates a very complete line of annunciator, burglar and fire alarm apparatus, bells, gongs, special signaling devices, door openers, door switches, automobile pushes and semaphore signals. In addition to the descriptive literature there is some interesting and useful wiring data and wiring diagrams.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is distributing an interesting piece of printed matter describing and illustrating apparatus for the automatic control of motors. This is shown in connection with house pumps and sump pumps, vacuum cleaners, blowers, air compressors and several kinds of machine tools. A connection diagram shows the method of controlling a motor from several locations or from different floors by means of snap switches.

Reed & Leonard, 705 American Building, Baltimore, Md., is the firm name of a partnership formed by Clinton G. Reed and Charles Leonard, to deal in electrical material, representing manufacturers in Baltimore, Washington and vicinity. Both are former employees of the Westinghouse Electric & Manufacturing Company, and are well posted as to conditions and personally acquainted with the trade. The concern will be pleased to hear from manufacturers who desire sales representation.

The Chelten Electric Company, Philadelphia, Pa., has issued a 1915 catalog of Chelten electrical specialties. These include push-button switches, brass switch plates, plug type receptacles, screw type receptacles, flush receptacles, attachment plugs, pressed steel switch boxes, cast-iron conduit boxes, adjustable ground clamps, standard and special plates, indicating heater receptacles and indicating switch receptacles. The various devices are the subject of careful illustration and the text explains in detail their characteristics and uses.

The Mabbs Hydraulic Packing Company, 109 North Canal Street, Chicago, is distributing some new literature relating to Mabbs rawhide packing. This packing has been on the market since 1890, and is made of braided strips of specially prepared rawhide. Due to the nature of the material of which it is made, the packing is anti-frictional for the reason that rawhide is practically a lubricant in itself. This packing is the invention and development of John W. Mabbs, a well known Chicago engineer, who has been for the last 30 years in charge of some of the largest power stations and isolated plants in the country.

The George Cutter Company, South Bend, Ind., has ready for distribution some interesting literature relating to a new line of Cutter street hoods for series and multiple circuits, adaptable for use with all sizes and types of incandescent lamps, including Type "C" Mazda lamps; electric lighting and wir-

ing devices, this covering the very extensive line of equipment of this character for which the Cutter Company is famous. There is also a bulletin describing Cutter ornamental lamp posts and an interesting series of questions and answers which give to the salesman a most instructive message regarding ornamental street lighting and the selling of Cutter posts.

The Joseph Dixon Crucible Company, Jersey City, N. J., is mailing an interesting card in the form of a miniature production of a barrel of Dixon boiler graphite. The card is printed in two colors and on the inside calls attention to the fact that for nearly four score and ten years the company has had at its command all forms and grades of graphite and therefore has no incentive to use or recommend other than the correct grade of Dixon boiler graphite. This graphite is said to reduce fuel consumption, prevents the hardening of scale and gives to the surface of the boilers a smooth polish preventing pitting and making the removal of scale easy by gentle mechanical action.

The Interstate Electric Company, New Orleans, La., will be pleased to send to those interested on request some interesting literature respecting the Ieco manifold plug and the Ieco steer warms. The manifold plug combines three separate devices into one. It may be used as a primer for priming the car without raising the hood; it may be used as an electric vaporizer to start the car on extremely cold days, and it is also claimed to be a gasoline saver when used as an auxiliary air valve. The steer warms are laced onto the steering wheel and in the small sizes consume about 18 watts. These enable the driver to keep a tight grip on the steering wheel and make driving comfortable in the coldest weather.

The K. & H. Trolley Wheel Company, Dayton, O., has placed on the market a trolley wheel manufactured under the Kissinger patents. The principal claim for the new wheel relates to its simplicity, the construction enabling the user of the wheels to change wheels by simply removing two nuts and lifting the wheels out. The metal used is of a special mixture and the combination of the wheel and harp produces, the manufacturers claim, the lightest weight equipment of this kind on the market. Through the use of a graphite bushing the wheel is automatically lubricated from a heavy grease reservoir. The manufacturers state that an average life of 25,000 miles on difficult roads has been shown in actual performance.

The Klingelsmith Electric Truck Company, 79 West Monroe Street, Chicago, has ready for distribution a bulletin describing its multi-battery system for electric vehicles. This bulletin presents a very interesting study for the equipping of electric vehicle service stations. A floor plan of a multi-battery system service station is shown, the dimensions in this plan being 100 feet wide by 160 feet deep. This area affords storage space for about 360 batteries and a capacity for supplying batteries to about 900 pleasure cars and trucks, while battery changes can be made at the rate of 250 per hour. Private service stations or small public service stations can be planned on the same lines, using as much or as little space as may be required for the number of vehicles to be handled.

Record of Electrical Patents.

Issued by the United States Patent Office, November 24, 1914.

1,117,965. Laminated Brush for Electrical Machines and Method of Making the Same. O. E. Becker, Chicago, Ill. Consists of carbon plates coated with copper.

1,118,004. Art of Transmitting Sounds by Means of Hertzian Waves. W. Harrison, New York, N. Y. Transmitting currents are modified by intermittent flashes of light.

1,118,006. Apparatus for Treating Liquids with Ultra-Violet Rays. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, France, assignors to R. U. V. Co. The liquid is introduced at the bottom of a rotating funnel, in the upper portion of which is a quartz lamp.

1,118,024. Electrical Switch. J. H. Lawrence, assignor to J. J. Geisen, Covington, Ky. Step-by-step drum switch.

1,118,035. Conductor-Cable Support. W. F. Meschenmoser, New Dorp, N. Y. Perforated partition with bushings for separating cables in joints of conduit.

1,118,087.—Street-Marker.

1,118,056. Conduit or Pipe Bender. C. Ross, St. Louis, Mo. The jaw opening is adjustable.

1,118,064. Electric Protection System. W. M. Scott, Radnor, Pa. Special circuit-breaker for a three-wire generator.

1,118,087. Street-Marker. T. Wight, assignor to Frank Tilk Ornamental Iron Works Co., Kansas City, Mo. A translucent name plate mounted on the post is internally illuminated. (See cut.)

1,118,099. Battery-Charging System. C. E. Beach, assignor to G. O. Kapp, New York, N. Y. Time-controlled cutout for charging circuit.

1,118,100. Trolley Stand. F. W. Bishop, assignor to Holland Trolley Supply Co., Cleveland, O. For mounting on top of car.

1,118,105. Trolley Device. S. H. Coyne, assignor to Westinghouse Electric & Mfg. Co. Electrically controlled pneumatically operated trolley pole.

1,118,116. Combination Woodworking Machine. W. A. Elliot, Toronto, Ont., Can. Includes a circular saw driven by an electric motor.

1,118,120. Selective Signaling Device. M. F. Geer and R. C. Leake, assignors to General Railway Signal Co., Gates, N. Y. A three-position electromagnet armature controls contacts through pawls and sectors.

1,118,121. Protecting Seal. C. A. Gillingham, assignor to National Carbon Co., Cleveland, O. Inverted trough-shaped battery terminal cover and seal.

1,118,126. Carbureter. R. W. Harroun, assignor to Electric Renovator Mfg. Co., Pittsburgh, Pa. Contains an electric heating coil.

1,118,148. Electrically Conducting Lubricant. G. Pommerhanz, assignor to Standard Chemical Co., Bayonne, N. J. Consists of emulsified metal salt of a fatty acid and water-soluble oil.

1,118,172. Method of Reproducing Electrical Variations. H. D. F. Arnold, assignor to Western Electric Co. Consists in establishing an ionized stream, maintaining a balanced non-arcing circuit through part of the ionized vapor and deflecting the stream to and fro.

1,118,173. Electric Relay. H. D. F. Arnold, assignor to Western Electric Co. Comprises means for producing an ionized stream, a deflecting electromagnet and an auxiliary cathode in the stream and in the field of the magnet.

1,118,174. Alternating-Current Generator. H. D. F. Arnold, assignor to Western Electric Co. Includes an oscillatory circuit in a field of ionized vapor.

1,118,175. Electric Relay Apparatus. H. D. F. Arnold, assignor to Western Electric Co. Includes means for producing an ionized stream.

1,118,176. Negative-Resistance Repeater. H. D. F. Arnold, assignor to Western Electric Co. Includes means for maintaining a state of ionization in the vessel.

1,118,188. Electric Switch. J. Desmond, assignor to W. S. Potwin, Chicago, Ill. Controlled by pressure through a diaphragm device.

1,118,200. Humidifier. J. I. Haynes, St. Louis, Mo. Electric fan moves an endless strip of fabric through a bath.

1,118,203. Standard for Electric Lamps. W. O. Holt, assignor to Livermore & Knight Co., Providence, R. I. Collapsible stand for portable lamp.

1,118,219. Sound-Recording Apparatus. J. Noll, assignor to American Telephonograph Corporation, Wilmington, Del. Relay-controlled electric recorder.

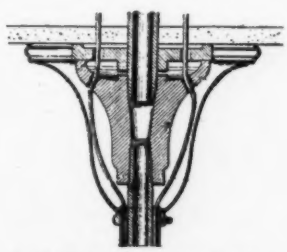
1,118,228. Oscillation-Detector. G. W. Pickard, assignor to Wireless Specialty Apparatus Co., New York, N. Y. Rectifier consists of the conducting non-copper compound of sulphur. Linnaeite, in contact with oxide of zinc.

1,118,230. Telephonic Instrument. G. R. Preusse, assignor to Detecta Phone Co. of America, New York, N. Y. A holder supports two receivers.

1,118,243. Lighting Fixture. C. D. Speelman, St. Joseph, Mo. Combination fixture with stiffening disk and connecting member having wire passages and joining the gas pipes. (See cut.)

1,118,256. Switch. C. J. Anderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has means for locking the switch in open position.

1,118,269. Means for Utilizing Waste Energy. J. L. Creveling, Wilmington, N. C. Exhaust from internal-combustion engine is conveyed to a thermoelectric generator which charges an ignition battery.



1,118,243.—Fixture Connection.

1,118,283. Carrier-Pigeon Signal. R. H. Holdefer, Baltimore, Md. Alarm with circuit-closer in a dove cote for actuation by the entering bird.

1,118,296. Accelerating Device for Alternating-Current Motors. W. D. Lutz, assignor to Otis Elevator Co., Jersey City, N. J. Comprises electromagnets with windings of different numbers of turns dependent for operation in regular succession upon current of uniform pressure and decreasing frequency.

1,118,311. Automatic Railroad Block System. P. J. Simmen, Berkeley, Cal. Interaction of cab and track circuits.

1,118,320. Electric Water-Heating Faucet. E. C. Webster, East Oakland, Cal., assignor of one-half to H. Gruenhagen. Has vertically disposed heating chamber.

1,118,324. Electric Switch. H. H. Berry and W. J. Markham, London, England. Inclosed in cast-iron box.

1,118,328. Temperature-Regulator. C. R. Burley, Yonkers, N. Y. Electric-motor-operated dampers and temperature control for the motor.

1,118,333. Electric Regulator. J. L. Creveling, New York, N. Y., assignor to Safety Car Heating & Lighting Co. Electromagnetically controlled variable resistance.

1,118,340. Transmitter Bracket. A. F. F. Glison, assignor to Western Electric Co. Sheet-metal bracket with adjustable lug.

1,118,371. Electric Locomotive. B. Schottelius, assignor to General Electric Co. The motor is above and geared to a jackshaft connected by side rods to the drive wheels.

1,118,380. Vapor Electric Device. W. E. Story, Jr., assignor to General Electric Co. Includes electric heater for anode.

1,118,382. Propelling Ships by Polyphase Electric Current. E. Thomson, assignor to General Electric Co. Includes induction generators operated in parallel at full load and concatenated at light loads. (See cut.)

1,118,387. Electrical Heating Device. E. Weintraub, assignor to General Electric Co. Electric-furnace resistor composed of a refractory core and a silicon shell electrically connected in parallel.

1,118,392. Electric Cooking Device. H. P. Ball, assignor to General Electric Co. Electric range with storage oven.

1,118,399 and 1,118,400. Electrode. J. T. H. Dempster, assignor to General Electric Co. Arc-light electrode consisting of a mixture of magnetite and titanic material with an addition of less than one-ninth in weight of chromite.

1,118,402. Electric Incandescent Lamp. F. Dickenschied, assignor to General Electric Co. Has three groups of filament holders.

1,118,408. Arc Lamp. R. Fleming, assignor to General Electric Co. Special feed and arc-striking mechanism for magnetite lamp.

1,118,410. Coherer. C. A. Glass, Greensburg, Kans. Rotating open cup with loose coherer particles over which is a terminal engaging successive portions thereof.

1,118,414. Flame Arc Lamp. C. A. B. Halvorson, Jr., assignor to General Electric Co. Magazine lamp with several parallel sets of electrodes.

1,118,416. Vehicle Signal. J. B. Hawks and H. R. Kennedy, Los Angeles, Cal. Solenoid-operated semaphore.

1,118,418. Electrical Terminal Device. R. H. Henderson, assignor to Westinghouse Lamp Co. Comprises a receptacle, molten metal contained therein and projecting above its edge and means for heating the metal.

1,118,422. Electric Master-Clock. A. Jabs, Zurich, Switzerland. Includes a continually rotating current-reversing contact.

1,118,433. Compensating Winding for Polyphase Commutator Machines with Drum Armatures. H. Meyer-Delius, assignor to General Electric Co. The stator winding is divided into two sections for each phase, each wound over 240 degrees, the two sections being relatively displaced by about 120 degrees and wound in reverse directions.

1,118,444. Maximum-Demand Indicator. L. T. Robinson, assignor to General Electric Co. Comprises a watthour meter element, an indicating wattmeter element and means for indicating the maximum reading of the latter.

1,118,446. Insulating Coil. H. Roos, assignor to General Electric Co. Consists of several turns of flat conductor each wound with insulating sheet.

1,118,454. Electric Cooking Apparatus. H. G. Weeks, assignor to F. C. Austin, Chicago, Ill. Oven with conductive heating element and a luminous radiant heating element.

1,118,464. Arc Lamp Electrode. M. H. Bake, Boston, Mass., assignor to American Flaming Arc Lamp Co. Has a longitudinally projecting metal feed-regulating strip.

1,118,467. Pistol Flashlight. J. Block, assignor to Interstate Electric Novelty Co., New York, N. Y. Has an electric lamp in the barrel, a battery in the handle and a contact on the trigger.

1,118,490. Automatic Telephone System. D. S. Huifish, assignor to Canadian Independent Telephone Co., Ltd., Toronto, Can. Includes means for disconnecting any of the lines from the busy-tone circuit and connecting it to the trunk circuit.

1,118,525. Automobile Signal. G. W. Barringer, Lawrence, N. Y. Electric lamps for automatically illuminating a semaphore arm when swung to operated position.

1,118,545. Wire-Clamp for Insulators. C. Giovannoni, Enterprise, Oreg. Has clamp plates adapted to hold the wire between them.

1,118,563. Ignition Device. T. J. Loftus, Castella, Cal., assignor of one-half to H. Bell. A contact is oscillated into intermittent engagement with spark plug.

1,118,571. Air and Electric Coupling for Railroad-Trains. B. C. Nelson, Oakland, Cal., assignor of one-half to W. Gregory. Includes switch and air valves simultaneously operated before opening or closing the coupling.

1,118,597. Baseball Indicator Board. H. B. L. Taggart and O. B. Wortman, Philadelphia, Pa. Has rows of electric lamps to indicate the course of the ball and runners.

1,118,608. Time-Element Device. N. Wilkinson, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Thermostatically controlled circuit-breaker.

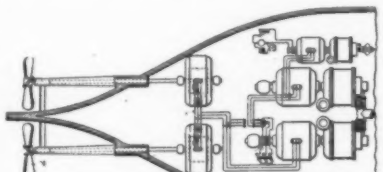
1,118,617. Power-Transmission Gearing. V. G. Apple, assignor to Apple Electric Co., Dayton, O. Electric starter for internal-combustion engine includes motor-dynamo, storage battery and automatic switches and clutch.

1,118,617. Power-Transmission Gearing. V. G. Apple, assignor to Apple Electric Co. Magnetically operated roller clutch for above.

1,118,623. Electric-Lamp Socket. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. Has coil spring lamp lock.

1,118,632. Automatic Voltage-Regulator System. G. A. Burnham, Essex, Mass. Includes a regulating transformer and automatic means periodically to vary its primary current with variations in load.

1,118,633. Automatic Voltage-Regulator. G. A. Burnham. Includes a constantly running motor-driven interrupter in the shunt



1,118,382.—Electric Ship Propulsion.

around part of the field resistance of the generator shunt field.

1,118,654. Safety Train-Control Apparatus. F. T. Jones, assignor to Jones Safety Train Control System Co., Baltimore, Md. Electrically operated through ramp rail contacts.

1,118,655. Calling Device. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Finger-operated; for automatic telephone.

1,118,678. Electrical Measuring Instrument. J. Patrick, Detroit, Mich. Special damping coil for D'Arsonval-type instrument.

1,118,684. Electric Arc Lamp. M. A. Ross, Chicago, Ill. Special mounting of lower electrode.

1,118,694. Disk Strain-Insulator. L. Steinberger, Brooklyn, N. Y. Comprises a disk with spiral ridge formed on its surfaces.

1,118,699. Permutation Electric Switch. G. Stupar, Chicago, Ill. Operated by tumbler lock.

1,118,717. Electric Indicator. J. W. Wiley and J. A. Kropp, Oak Park, Ill. A number of adjustable circuit-closing disks are rotated together.

1,118,737. Automatic Compression Refrigerating Apparatus. G. P. Carroll, Bridgeport, Conn. Includes electrically driven and controlled compressor.

1,118,751. Attachment for Wall Telephones. A. E. Ellsworth, Oakes, N. C. For holding receiver to the ear.

1,118,763. Electric Stove. W. V. Hardy, Indianola, Miss. Heating elements assembled in box.

1,118,765. Electrical Sign. T. S. Hastings, Detroit, Mich. Includes a number of high-potential lamp circuits and individual circuit-breakers for each.

1,118,772. Timed Controlling Device. W. I. Hoopes, Jr., Ardmore, Pa. Alarm clock closes switch.

1,118,780. Telephone Transmitter. A. D. Jones, Philadelphia, Pa. Covers details of construction.

1,118,797. Automatic Train-Stop. W. S. Pike, Red Oak, Iowa. Motor-driven means for actuating the locomotive throttle valve and air-brake valve.

1,118,827. Electrical Fitting. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Combined switch and pilot light.

1,118,847. Attachment for Trolley Harps. W. Eggers, Baltimore, Md. Has grooved guide rollers on each side of the wheel.

1,118,866. Sign. J. J. Jones, Pittsburgh, Pa., assignor of one-half to G. H. Blaxter. Electric lamps behind translucent letters.

1,118,686. Metallic-Vapor Lamp. F. Kerschbaum, Cambridge, England. Quartz mercury-vapor lamp with two radial magnets on opposite sides of the lamp.

1,118,870. Scrubbing Machine. W. J. Lane, Chicago, Ill., assignor of one-half to M. H. Swafford. Includes motor-driven pump.

1,118,872. Electric Iron. W. S. Lyle, Jr., San Francisco, Cal. Has pilot lamp in the end of the handle directly over the point of the iron.

1,118,891. Train-Control System. J. Ames, Montrose, Iowa, assignor of one-sixth each to L. C. Miller, J. C. Schee and T. S. Robinson. Combined electric signaling and control system, governed by track circuits.

1,118,892. Train-Control System. J. Ames, assignor of one-sixth to L. C. Miller and one-eighth each to G. Brown, J. C. Schee, T. S. Robinson and E. Leech. Modification of above.

1,118,900. Mercury-Tube Switch. T. B. Freas, assignor to Thermo Electric Instrument Co., Newark, N. J. Has adjustable needle contact.

1,118,905. Seal for Vapor Electric Apparatus. R. D. Mailey, assignor to A. A. Noyes, Boston, Mass. Has a pulverulent barrier covering the seal.

1,118,906. Manufacture of Electrical Resistances. A. W. Maley, Harnsworth, England. Soft-iron grid is formed and then case-hardened.

1,118,910. Automatic Telephone System. A. H. Dyson, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Special vibratory relay for extending the trunk circuit to the called line.

Patents Expired.

The following United States electrical patents expired November 23, 1914.

593,981. Apparatus for Electrically Heating Metals and Ores. G. D. Burton, Boston, Mass.

593,984. Trolley. R. W. Clarke, Victoria, Canada.

593,986. Separable Recording Meter. J. R. Cravath, Chicago, Ill.

593,988. Resistance Device. G. K. Cummings, Chicago, Ill.

594,020. Apparatus for Feeding Cables into Underground Conduits. W. H. Johnston, St. Louis, Mo.

594,060. Telephone. T. Berdell, New York, N. Y.

594,069. Means for Regulating Operation of Elevators or Traveling Cars. F. L. Emery, Lexington, Mass.

594,034. Automatic Circuit-Controller. C. W. Price, Newark, N. J.

594,051. Electric Battery. D. S. Williams, Philadelphia, Pa.

594,122. Indicator for Underground Electric Railways. H. C. Reagan, Jr., Philadelphia, Pa.

594,131. Bell Extension for Telephones. E. S. Dickerson, Philadelphia, Pa.

594,143. Regulating Roentgen-Ray Tubes. M. P. Rice, Schenectady, N. Y.

594,144. Regulation of Alternating-Current Systems. C. P. Steinmetz, Lynn, Mass.

594,145. Inductor Dynamo. C. P. Steinmetz, Schenectady, N. Y.

594,150. Starting Device for Alternating-Current Motors. W. J. Foster, Schenectady, N. Y.

594,155. Section Insulator. J. Hoffman, Schenectady, N. Y.

594,156. Roentgen-Ray Tube. I. W. Howell, Newark, N. J.

594,192. Automatic Burglar-Alarm. J. W. Baughman, Dalton, O.

594,198. Switch-Operating Mechanism. C. Elwee, Allegheny, Pa.

594,227. Electric Switch. A. C. Brockies, London, England.

594,247. Electric Cable. J. D. Gould, Brooklyn, N. Y.

594,256. Electric Railway Signal and Safety Device. K. Korn, Seward, Nebr.

594,281. Automatic Signaling System. C. W. Price, Newark, N. J.

594,306. Electric Time Switch. A. B. Williams, Waco, Tex.

594,313. Storage or Secondary Battery. R. Ashley, Port Republic, N. J.

594,363. Telephone System. A. F. Swan, Bayonne, N. J.

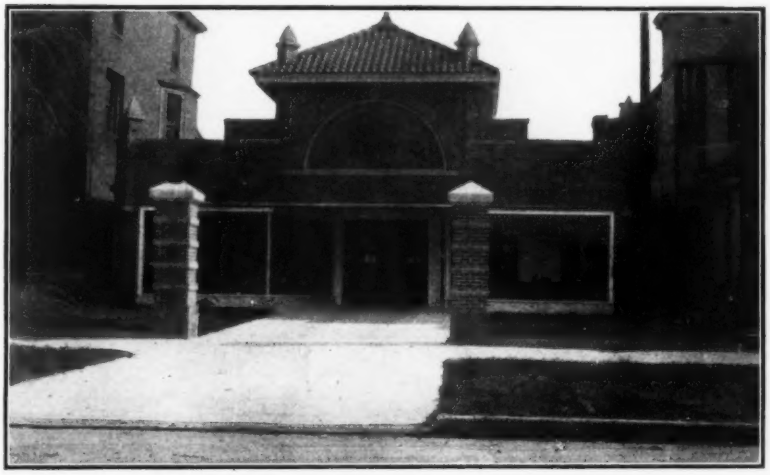
Electric Vehicle Section

A New Electric Garage for Charging on the Constant-Potential System.

Just getting under way in Louisville, Ky., is the Electric Garage Company, which is inaugurating in that city an exclusively electrical proposition, with every prospect of building up a large and profitable business. The plan of the enterprise, the location and accommodations and, more important still, the equipment, all partake of novelty, while the business itself should blaze the way for similar ventures in cities all over the country.

The plan is to specialize on electric vehicles and on fast and efficient service; the location is in the heart of one of the fashionable residence sections in a building which harmonizes with the residences adjoining it, and the equipment is the first that the General Electric Company has installed complete in the way of motor generator systems of charging on the constant-potential plan.

Besides that, the company is agent in the Louisville district for the Ohio Electric, one of the most popular cars in the field, a circumstance that goes a long way toward insuring constant growth of the business handled by the garage as successive sales of the car are made, it being reasonable to expect that nearly every car which the company sells will be taken care of at the garage which sold the vehicle. George G. Bader, who is president of the company, previously represented the Ohio company in Louisville, and was persuaded to go into the garage company when it was organized in order that a high-class machine would be identified with the new venture, and so that owners of Ohios in Louisville would be interested in it from the start.



Front View of Electric Garage, Louisville, Ky.

The company was organized with $25,000 capital. After electing Mr. Bader president the directors chose J. P. Ouerbacker, vice-president; F. S. Ouerbacker, secretary, and J. Woodford Button, treasurer. This done, the ground for the site of the garage was purchased at 1817 South Third Street, and plans for the building were gotten under way at once. Neighbors at first showed a disposition to protest, but when they were made familiar with the details of the company's program these objections were removed and the construction went ahead.

Several things determined choice of the location. First, it must be in a neighborhod where there were numerous people who owned or could afford electrics. It must be on a main traveled thoroughfare, and Third Street, wide, level, well paved from the river to Iroquois Park, probably the most used automobile road in the city, met this test, as the locality met the other. Again, the site of the garage must be approximately on the level of the street, so that even totally discharged cars could be driven into it. This condition was fulfilled by the site selected.

The houses in the same block, the east side of Third Street between Bloom and Avery, are of a previous date, substantial though not showy, but they are occupied by families of means, refinement and careful of the general appearance of the block. Immediately opposite is the Magnolia Garden, a popular restaurant and outdoor resort where food and drinks are served, and where, in the summer especially, there are always numbers of cars, both gas and electric, parked at the curbing. These surroundings made some rather important architectural requirements,

Interior View of Electric Garage, Louisville, Ky.

the first one being that the garage must be set back on a line with the adjoining houses, so as not to give offense. The company gave up 34 feet of depth from the sidewalk line to do this, but it pleased the neighborhood and will be able to beautify the grounds and thus constantly attract attention to the garage of all passersby.

As will be seen from the illustrations, the character of the front of the garage is neither pretentious nor unduly plain, and with the big windows of the salesroom and the office and wide entrance doors, which can stand open during reasonably mild weather, is quite inviting. It is mostly garage, at that, with space in the salesroom for but two cars. The garage proper has a floor area 110 by 50 feet, and the whole building is as nearly fireproof and indestructible as it was possible to make it. Chemical fire extinguishers are supplied to take care of incipient blazes which might develop in cars from causes over which the garage company has no control.

Mr. Bader was the principal designer of the garage, which was built at a cost of approximately $8,000. One of the best things about the floor is that there is not a pillar in it, while the tops of the cars do not reach to more than within six feet of the steel trusses by which the re-inforced concrete roof is supported. Any garage superintendent who has had them to contend with knows how much dead space a post makes in a garage floor. The walls throughout are of brick, and the floor of concrete, with a waterproof cement dressing, the floor being level except surrounding the washing rack, where drains are located. The overhead washing system is employed, electric lamps in beehive-shaped reflectors suspended at the proper angle lighting each side of the car standing on the rack and supplying the right light for polishing without need of turning the car around. Prismatic glass windows in the rear wall and two prismatic glass skylights insure daylight, while an adequate electric lighting system has been provided for general purposes at night.

There is floor space sufficient for about 50 cars at a time, and the company has provided room for expansion on either side and at the rear, where in the immediate future a two-story building for repair and shop work and additional garage room is to be provided. Another feature of the garage is the concrete bumper extending out from each of the side walls about 28 inches, with a beveled edge. This makes alinement of the cars easy and prevents injury to them by bumping into the wall, while it gives sidewalk room sufficient for the attendant to pass between the cars and the wall to inspect the batteries while they are being charged. Lamps on extension cords are provided to assist in this work.

Although only a very few of the electric garages in the country have made use to date of the constant-potential system of charging batteries, one in New York and another in St. Louis being the only examples generally known, the principles are well understood by the electrical trade. However, it has been found more or less necessary to explain to numbers of Louisville car owners the whys and the wherefores of the system, and for this purpose Mr. Bader draws an interesting parallel between flowing water and flowing electricity.

The charging process may begin at an amperage as high as 150. At the end of 30 minutes this is likely to be reduced to 75 amperes, at the end of an hour to 40 amperes, while the finishing rate at the end of about three hours and a half would figure at from 8 to 12 amperes. Of course, the management does not take chances with cars and batteries it does not know the condition of. They are put connected in series with rheostats. It is not unusual for patrons to caution the company that their cars won't take more than 22 amperes without "burning up," and when these owners see electricity being "poured in" at 150 amperes, they acquire an enthusiastic interest which promises well for the "pleased customer" advertising the garage will get. Operations began the first of November and to date the temperature on no machine has approached 10 degrees Fahrenheit, while normal charging operations are being undergone.

Installation of the equipment was made under careful direction of engineers sent direct from the General Electric Company's headquarters. The motor-generator set, operating with central-station current, occupies a concrete base in the rear of the garage. It has a normal capacity of 292 amperes, with an overload capacity of 50 per cent, and the automatic circuit-breaker is set at 375 amperes. This current is regulated by a Tirrill regulator to maintain a constant voltage under all conditions of load and with any number of machines up to the total carrying capacity. By 600,000-circular-milmain feed wires the current is carried through the generator panel to twelve outlets, being distributed through two distributing panels, one at the middle of each side of the garage. Three rheostats are used only for each of these panels, each of which is connected with three charging outlets, set far enough apart along the walls so that when the garage is full there will be three cars backed up against the bumpers to each outlet. The company bought six rheostats for each distributing panel, but finds that three on each side would answer for double the capacity, while Mr. Bader says that a portable rheostat would answer all purposes.

All the wires are inclosed in steel conduits and nothing is exposed except the flexible cables which end in the charging plugs. These plugs, devised by Mr. Bader and made under his direction, are interesting, being built according to the usual pattern, though much larger. They were found to be necessary because the ordinary plugs blistered with the heavy current carried through them. The large plugs used were made by soldering the ends of the wires to copper lugs, which in turn were bolted to copper lips, with sufficient spring to insure that they would engage with the plug sockets. The reverse end of the plug, incased in wood with removable top, is cut so as to admit the entire cable, thus protecting it. The whole makes a plug heavy enough to avoid any chance of trouble.

The company started with about 15 machines assured and has been adding to them regularly. Nothing like capacity application is required. In fact, charging does not begin to any extent until about 11 o'clock at night, and the equipment makes easy work of it. Very little attention is required, once the connections have been made. For instance the operator can begin on two totally discharged cars. In half an hour or less, supposing a beginning was made at 150 amperage on each, there would be another 150 amperes available to begin charging a third totally discharged battery. Soon another could be attached. As the charging decreases, more room would be made for others, and as the curve keeps going down, still more and more cars can be added until all the plugs are at work. Mr. Bader says the working capacity of this garage is very nearly three times, at its best, that of the old types. Four hours are required for each car, instead of the 8 or 12 under the old method.

The regular cables from any charging outlet will reach three cars backed into place, while there are several extra long cables provided so that more cars still can be charged while standing in the open space on the floor, that is, the aisle down the center. Without any further preparation, the garage now has ample accommodations for 50 cars. Besides, it is in position, during the noon hour, to refill or at least boost truck batteries so that service can be provided for the rest of the day. There has not been a hitch in operations so far. Much attention has been attracted to the installation from electrical engineers from many parts of the country.

GENERAL VEHICLE COMPANY, INC.
LONG ISLAND CITY, NEW YORK
NEW YORK—CHICAGO—BOSTON—PHILADELPHIA

THE VALUE OF THE AMPERE-HOUR METER TO DRIVERS OF ELECTRIC TRUCKS.

A. R. Cordner.

The simplest and at the same time the most logical and dependable instrument for ascertaining the condition of both battery and bearings, chains, gears and so forth of the electric vehicle is the ampere-hour meter when used in conjunction with an accurate and reliable odometer.

Fig. 1.—Regulation Auto-Type Ampere-Hour Meter.

One of its first advantages is its ruggedness, there being no jeweled bearings as in most types of instruments, the moving element being floated in mercury resulting in extreme accuracy of records throughout a long period of service.

Fig. 1 illustrates the regulation auto type meter.

It will be noticed that the dials register 200 ampere-hours per revolution of the movable hand, while the stationary pointer is set at 130 ampere hours. This latter figure, in this instance, represents the danger point or in other words the total discharge capacity of the battery. The ease with which a driver may determine the mileage yet available is apparent. By a quick glance at the dials he may find that the movable hand has traveled one-third, one-half or any other fraction of the distance to the set pointer and so roughly estimate the number of miles he yet has to travel before requiring a recharge. If it is found that there is some doubt as to his ability to cover any given distance, it may be set at rest by dividing the miles run into the ampere hours used, thus obtaining the ampere-hour consumption per mile. It is then only necessary to repeat this operation, using this time the remaining ampere-hours of the total discharge limit to determine the number of miles which may still be traveled. This distance could be determined to within almost 100 feet if it were not for the fact that the voltage of the battery decreases as the charge nears the end, the ampere-hours per mile increase, but it will only take an intelligent operator a few days to determine the allowance necessary for this increase.

The exactness of such information will often, by the selection of smooth and level roads, allow a machine to reach the garage when any other method would likely have resulted in a tow-in.

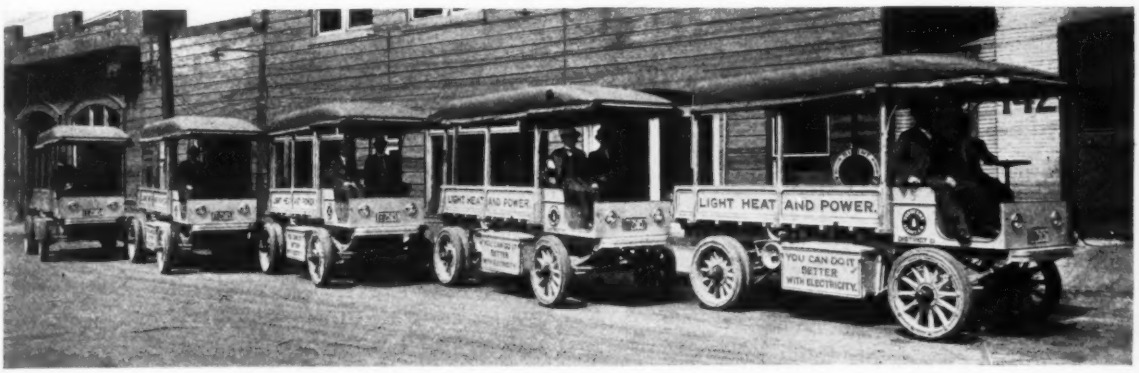
Fig. 2.—Ampere-Hour Meter with Dial Showing Trip Discharge and Total Amount of Current Given or Discharged While Battery is in Service.

Fig. 3.—Ampere-Hour Meter, with Two Sets of Totalizing Dials for Trip and Aggregate Records.

Pittsburg the city of hills adopts

The "Ironclad-Exide" Battery

the efficient and economical battery for any road or any load



One real test for an electric vehicle battery is its ability to give good service at low cost, day in and day out, when used in districts that are very hilly.

The increasing use of the "Exide" Batteries — especially the "Ironclad-Exide"—in and around Pittsburg is very conclusive evidence of the high quality of these batteries, the use of which is growing so rapidly in all parts of the country.

The illustration above is a photograph of 5 two-ton electric trucks recently put in service by the Duquesne Light & Power Co., of Pittsburg, all of which are equipped with "Ironclad-Exide" Batteries.

The Westinghouse Electric & Manufacturing Co., of Pittsburg (undoubtedly an exceptional judge of batteries), also operates 3 electric trucks and 2 electric locomotives equipped with "Ironclad-Exide" Batteries.

The McCreery Co., The Western Pennsylvania Humane Society, The Rosebaum Company, "The Pittsburg Lunch," The Kuhn Co., etc., are a few of the other prominent companies in Pittsburgh using "Exide" Electric Vehicle Batteries.

The largest and most prominent Central Stations in the country are large users of "Exide" Batteries.

It's a wise and profitable policy for Central Stations to recommend "Exide" Batteries among electric vehicle users.

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator", The "Tudor Accumulator"

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New York, Boston, Chicago, St. Louis
Cleveland, Atlanta, Detroit, Rochester
886 "Exide" Distributors

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1888-1914
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Denver, Washington, San Francisco, Seattle
Los Angeles, Portland, Ore., Toronto
"Exide" Inspection Corps

With the ampere-hour meter as a guide, the operator is at all times posted as to the condition of his battery, the general condition of his machine and can even by experience learn to regulate his load for particularly long or rough runs.

The great advantage of the method may be illustrated thus: take a ten-mile trip using an indicating ammeter, the excess current used at a given instant in climbing a hill or traveling over heavy ground will not be properly interpreted by the average driver, while he will be able with the ampere-hour method to guide his movements every mile by the average current consumption of the preceding. The latter method requires no difficult calculation.

When it is found that the current consumption per mile is increasing regularly, it is the sign either that there is excessive and increasing friction in the bearings of the machine or that the battery is deteriorating and will not give the same mileage and total discharge. If on the other hand this increase is sudden and excessive, some serious mechanical trouble is likely developing, and an immediate report by the driver may prevent a laying-up of the wagon and expense by having repairs made at the start. There are other instances where the old type of indicating instruments would most likely not give warning which would be recognized.

It might be said here that a reliable odometer is also necessary to insure best results, one that is water and oil proof and that registers in one direction only, not depending on the direction of travel. This is particularly important where extreme accuracy is desired in order to figure hauling costs per pound-mile or for yearly current consumption records.

Another time when the ampere-hour meter is of service is when a boost is found necessary. It may so happen that a partial charge is obtained where an unreliable, and in some cases where there is no instrument available. In such an instance the meter on the wagon comes to the rescue and the amount of electricity needed to complete the trip is put into the battery with the least delay. The result of using the instrument is more mileage, more careful and intelligent driving and longer battery and machine life.

It is often desirable to keep a record of the current given by a battery over an extended period. This can be done with a minimum amount of clerical work by using a meter (Fig. 2) with a dial, showing in addition to the circular or trip dial, the total amount of current given or discharged while the battery is in service.

Meters are obtainable with two sets of totalizing dials (see Fig. 3), one showing the number of ampere-hours which have been put into the battery and the other the number of ampere-hours which have been discharged or taken out up to any period.

The lower or charge dials may also be had to read in kilowatt hours if desired. In both of these meters last mentioned, however, the circular or trip dials is absent and though simplifying records are not as effective as the first two as a guide to the operator. The writer prefers either the meter illustrated in Fig. 1 or Fig. 2 which are generally used; with those supplied with the trip pointers it is only necessary for the driver to make entries on his garage report of the mileage and ampere-hours from which the garage records may be made up. Many of these daily drivers' reports contain in addition to the mileage traveled and current consumed, such additional information as condition of roads, weather and weight of load carried. With such information a very accurate check may be had on the performance of the driver and vehicle.

The advantages claimed for the ampere-hour meter in commercial work are also found by their use on pleasure vehicles in which case the distant dial is used (Fig. 4 and 5). This is a neat dial which can be mounted flush on the dashboard of the machine or any other desirable location, the meter proper being located out of view.

Fig. 4.—Distant Dial for Ampere-Hour Meter for Pleasure Vehicles.

Fig. 5.—Distant Dial for Ampere-Hour Meter for Pleasure Vehicles, Equipped for Trip and Total Readings.

Lincoln Battery-Charging Equipment for Private Garages.

For a long time it has been felt that the use of electric vehicles, particularly of the non-commercial type, would increase considerably if simple and reliable means were available to the private-car owner for charging the battery of his vehicle on his own premises. Many people wish their cars to be always under their own supervision and immediately accessible. The expense and relative complexity of much charging equipment for use on alternating-current lines has militated against private electric garages. To meet this condition the Lincoln Electric Company, Cleveland, Ohio, has developed and placed on the market a compact and simple battery-charging set designed particularly for electric pleasure cars using lead-type storage batteries.

In designing this equipment the manufacturers adopted what they considered to be the most rugged and easily operated type of rectifying apparatus, the motor-generator set, believing it to be much preferable in the long run to the mercury-arc rectifier or rotary converter. The control equipment was also simplified so that it is necessary merely to close and open a switch in starting and ending the charge. The motor-generator is so designed and adjusted as to give prac-

Gould Storage Battery

Here is a typical example of how our hard-paste, high-capacity, long-life plates act in delivery service:

"The battery purchased from you Oct. 12th, 1911, ran up to July 15th, 1913, with but one cleaning. On taking this battery apart we find that the active material in the positive plates is now very thin but still hard and gritty; the negative plates also look very good."

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We succeeded in making really superior plates for vehicle service four years ago, only after years of experimenting. We knew then that our manufacturing process and our construction were right but we proceeded to prove the merit of these plates by hard tests on heavy trucks, delivery wagons and the like.

Our booklet, "What Gould Vehicle Batteries Are Doing," cites typical performances that are worth careful attention from every electric user.

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GMC Electrics are thrifty in the consumption of battery power because of exclusive features in design.

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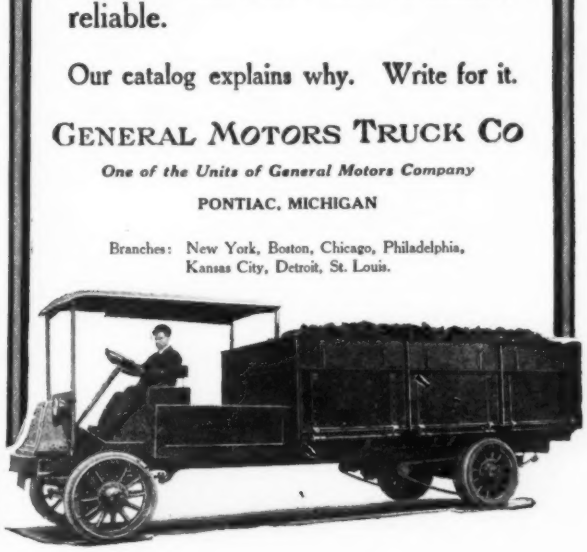

tically constant-potential charging, thus providing automatically the tapering charge that has been found so advantageous for lead batteries.

A good idea of the Lincoln charger complete is obtained from Fig. 1. It consists of a two-bearing motor-generator with a common and well ventilated casing. The motor is a single-phase induction machine. The generator is a compound-wound, commutating-pole, direct-current dynamo. Each

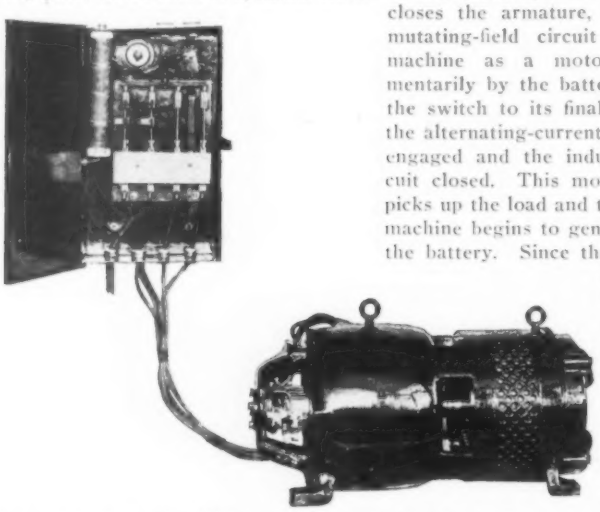

Fig. 1.—Lincoln Battery-Charging Equipment for Private Garages.

machine is of ample size to give a heavy charge to the standard sizes of batteries used in pleasure cars. These machines are connected by a six-wire cable to the small control panel. From the latter runs the charging cable to the vehicle. The control panel is shipped in the same crate as the machine set and is all wired up and ready for fastening to the wall. The alternating-current supply wires are secured to the two vacant switch lugs; the motor-generator may be placed directly on the floor of the garage: thus the work of installation is extremely simple and does not require experts. The compactness of the entire set can be seen from Fig. 2, which was taken in a private garage.

The control panel consists of a four-pole switch, two poles of which are for the direct-current dynamo and two for the single-phase motor. Each switch blade is fused. A shunt-field rheostat completes the panel, which is inclosed in a steel cabinet. In the latest forms of the control panel a round field rheostat is used in place of the resistance tube and resistance-control switch shown in the upper left-hand corner of the panel. The four-pole switch has also been changed by making the two middle blades serve for the direct-current dynamo. These dynamo blades have an extra pair of clips in the middle which are the terminals of the shunt-field circuit, including the rheostat referred to.

In closing the switch, these two intermediate clips are engaged first, thus energizing the shunt field from the battery, which is connected by the charging cable to the hinge contacts at the base of the switch. On pushing the switch further, the dynamo blades next engage the upper clips, which serve as the main dynamo terminals. This closes the armature, series and commutating-field circuit and starts the machine as a motor supplied momentarily by the battery. On pushing the switch to its final closed position, the alternating-current supply clips are engaged and the induction-motor circuit closed. This motor consequently picks up the load and the direct-current machine begins to generate and charge the battery. Since the machine set is mounted on ball bearings, the torque required to start the armature and rotor is small and consequently the brief starting load on the battery is not very heavy. This method of starting has several advantages: it insures having the polarity of the dynamo correct in each case; it dispenses with all starting boxes, compensators, or other starting gear; it reduces the starting to merely the closing of a switch which is done with brief pauses on the two first steps to give the rotor a chance to gain some speed.

To insure having the proper direct-current voltage, the field rheostat is set at the factory to suit the number of cells constituting the battery. For this purpose guide marks for 38, 40, 42 and 44 cells, which are the number commonly used, are provided on the edge of the new type of rheostat, which is adjusted to the proper point and then secured from further general change by tightening three screws. A rheostat handle with a limited range of adjustment permits changing the field strength slightly so as to make the end of the charge vary between 3 and 7 amperes. This slight adjustment is the only one that need be made by the car owner. It permits, however, an adaptation of the charge to the use the battery has received and permits an occasional overcharge in the same time usually devoted to charging.

It is presumed that in most cases the user will put his battery on charge in the evening and the set has been designed to enable him or her to do so and to leave it all night. Since charging is on an automatically tapering rate due to gradual increase of the counter electromotive force of the battery, when the latter has received substantially full charge the current is very low (between 3 and 7 amperes) and this rate has been found to be practically not injurious, considering the normal charging rate for pleasure-vehicle lead batteries. Consequently the manufacturers claim that continued charging, even after the charge is normally complete, at this low rate is better than to depend on the reliability of some automatic cutoff device to open the charging circuit and shut down the set when the charge is complete. The set may therefore be left charging all night and each charge will be a full charge.

In case the power is momentarily off during the charge the set continues

Fig. 2.—Compact Arrangement of Lincoln Battery-Charging Equipment.

to run, the generator operating as a direct-current motor fed by the battery; it is thus ready to resume charging instantaneously and without any attention, when the alternating-current supply is restored. The rotors run in ball bearings and therefore the current taken to operate the set idle in this reverse condition is extremely small, being only in the neighborhood of one ampere. Consequently no serious discharge from the battery results, even though the power supply were interrupted for several hours. This eliminates the need for a no-voltage circuit-breaker and the need it would involve of restarting the charge; to do the latter automatically would require complex equipment, something it has been aimed to avoid in every feature of the outfit.